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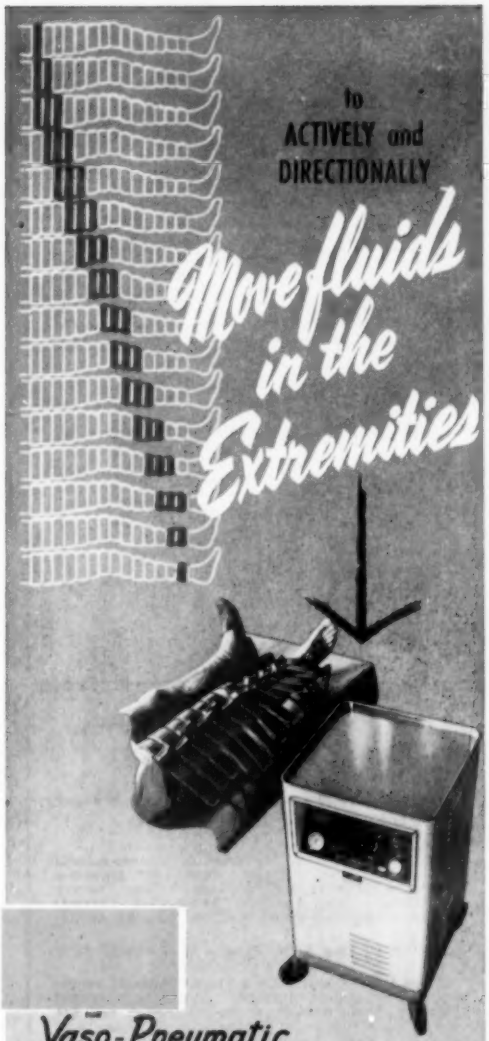

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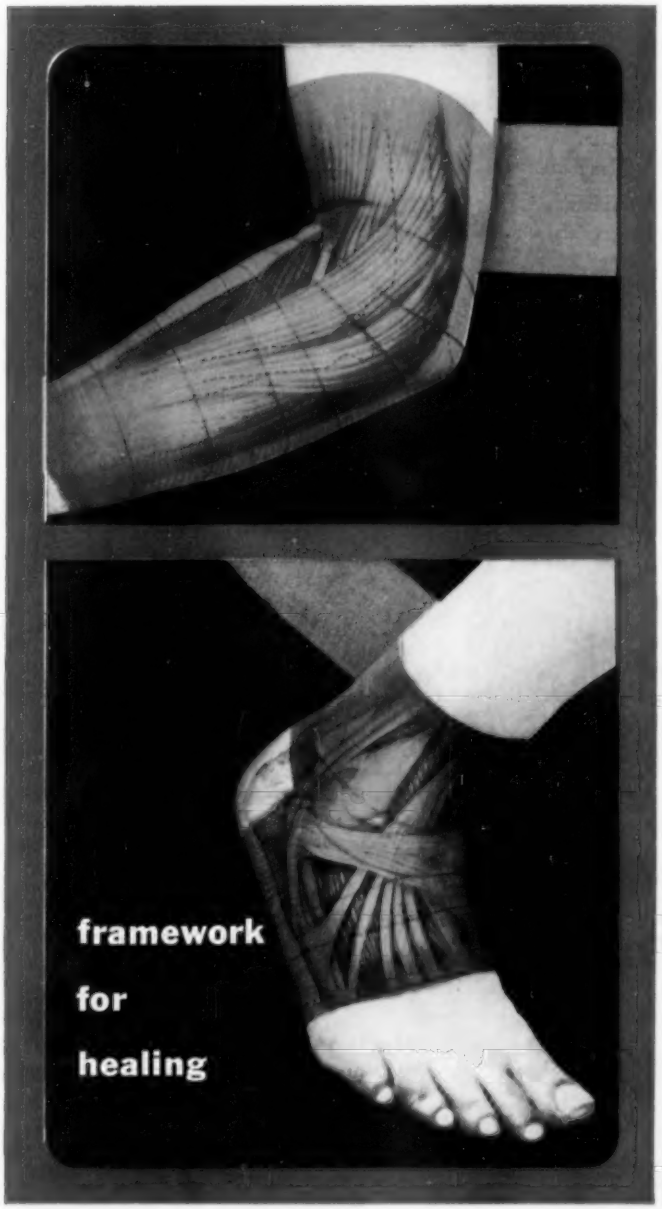

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Effect of Various Exercise Programs on Isometric Tension, Endurance and Reaction Time in the Human

Adrian D. Baer, M.D.
Jerome W. Gersten, M.D.
Barbara M. Robertson, M.S.*
and
Harold Dinken, M.D.
Denver

Introduction

Exercise programs, prescribed so frequently in the physiatric care of the patient, are often given without any certainty as to which aspect of muscle function will be most affected. This difficulty is well exemplified by studies on the relatively simple system consisting of frog striated muscle fibers *in vitro*. In this preparation, different functions, such as rate of work production, isotonic work performance, and isometric extratension, have their optima at different physical states of the muscle.[1]

With this in mind, one may well consider that the problem is far more complex in the *in vivo* preparation, and that an exercise which is optimal for one function may not be so for another. This was considered by DeLorme and his coworkers in the statement that low repetition high resistance exercises were more suitable for the development of power, while high repetition low resistance exercises were more useful for the development of endurance.[2]

More quantitative information concerning the effect of exercise on muscle functions is evidently desirable in order to prescribe more accurately. The purpose of this study was to obtain such data with respect to three aspects of neuromuscular activity-isometric tension, endurance, and reaction time. As far as isometric tension was concerned, particular emphasis was placed on the rate at which the exercise was performed. Although the rate of exercise is not usually considered a critical factor, there is much evidence relating tension developed by muscle to the velocity of shortening,[3-5] and other observations relating hypertrophy of muscle to the amount of tension developed during contraction.[6-11] Thus it would seem that the speed of exercise was a parameter which could not be easily ignored.

Methods

Before the exercise programs were begun, control values for isometric tension, endurance and reaction time were determined.

Isometric tension of the wrist flexors was recorded with a strain-gauge system and Leeds-Northrup d-c amplifier. Details of this system are described elsewhere.[12,13] By using straps, the forearm was stabilized in mid-position between pronation and supination, and the angle at the elbow was fixed at 90 degrees. The palm and the steel bar to which the gauge elements had been cemented were parallel and touching, with the distal border of the bar opposite the

From the Department of Physical Medicine and Rehabilitation, University of Colorado School of Medicine.

Abridgment of theses submitted by Dr. Baer and Miss Robertson to the Faculty of the Graduate School, University of Colorado, in partial fulfillment of the requirements for the degree of Master of Science.

This study was aided by a fellowship from the National Foundation for Infantile Paralysis, Inc.

*Now at Brooke Army Medical Center, Fort Sam Houston, Texas.

metacarpophalangeal joint of the second digit. The thumb exerted no force on the bar. The tension developed by the wrist flexors on slow isometric contraction of approximately 5 seconds duration was recorded by the d-c amplifier. The average of 3-5 readings was used in calculations.[14]

Work capacity was determined with an ergograph.[15,16] Again the elbow was fixed at 90 degrees, so that only flexion and extension at the wrist took place. The weight lifted on contraction of the wrist flexors was 75 per cent of the maximal isometric tension developed by each subject. The rhythm was kept by a metronome so that there were twenty complete cycles of flexion and extension per minute, through complete range of motion at the wrist. This was continued until the subject could no longer move the hand smoothly through the complete range of motion at this rhythm. The total distance through which the weight was lifted was measured with an integral counter.[17] The product of weight lifted and total distance represented the work done before fatigue was evident.

As a simple index of coordination, the time between the application of a touch stimulus to the dorsum of the fifth metacarpophalangeal joint of the left hand and a complex response of the right upper extremity was measured. The subject was seated, with the right forearm on a table, the forearm and hand being in mid-position and the elbow flexed at 90 degrees (fig. 1).

The position of the hand and forearm were fixed with relation to the door shown in figure 1. A touch stimulus was applied to the left hand by means of a solenoid activated by a 22-volt battery. As far as could be determined, the force with which the plunger struck the skin, and the area of skin contacted were constant — factors which have been shown elsewhere to be important because of their effect on reaction time.[18] As soon as possible after application of this stimulus, the subject was required to move the door through an arc of 45 degrees against a resistance of 3.25 pounds. This required that he pronate and extend the right hand, raise and extend the forearm to strike the door with the palm of the hand. By an appropriate electric circuit (fig. 2), this interval of time could be measured, using a 60-cycle per second time marker, with the make corresponding to closure of the signal switch which activated the solenoid, and the break

Fig. 1 — Equipment used for the determination of reaction time. A represents a step-down transformer; B a coupling transformer; C a potentiometer; D the solenoid for application of the touch stimulus; E a carbon brush for maintaining electrical contact with the copper plate; F,G the point at which movement of the door results in interruption of the primary circuit; H a cathode ray oscillograph; and I a camera.

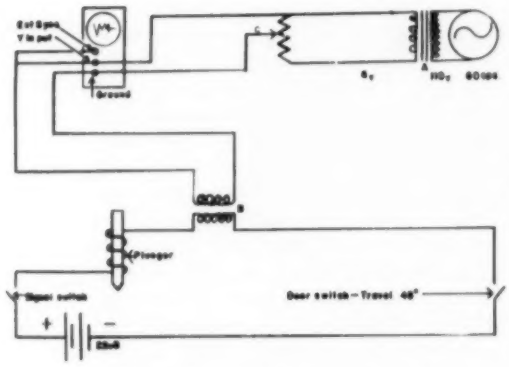

Fig. 2 — Circuit diagram of the apparatus used for the determination of reaction time. A represents a step-down transformer used for providing the time marking. The voltage is further reduced by the potentiometer, C. B represents a coupling transformer through which the time of stimulation and the completion of motion of the door through the 45 degree arc may be visualized on the cathode ray oscillograph.

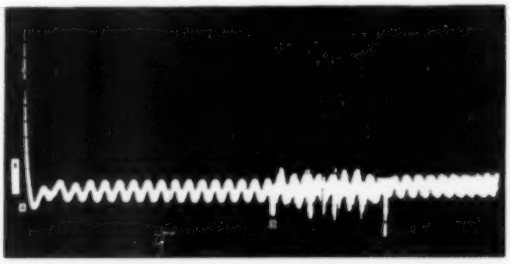

Fig. 3 — Reaction time record. A represents the time of application of the touch stimulus; B the time at which the primary circuit is broken by movement of the door through the 45 degree arc.

Table 1: Description of Exercise Programs

Group No.	Group Name	Rate of Contraction Per Min.	Mean Daily Load, Pounds	Duration of Program, Weeks
I	High Resistance Isotonic Contraction	10	28.6	4
II	High Resistance Isotonic Contraction	30	27.6	4
III	High Resistance Isotonic Contraction	30	31.2	4
IV	Low Resistance Complex Motion	10	3.25	6
V	High Resistance Isometric Contraction	10	>50	6
VI	High Resistance Isotonic Contraction	10	24.5	6

corresponding to complete opening of the door through 45 degrees. Figure 3 shows a sample record of a reaction time determination.

Sixty-three normal subjects were divided at random into six groups. The only known deviation was the placing of two males in each group of eight or nine females.

The exercises performed are shown in tabular form (table 1). In all groups, excepting Group IV, the only completed or attempted motion that took place was at the wrist, with the wrist flexors developing tension in order to lift a weight. In all these groups (I through VI), there was a preliminary warm-up period of 10 contractions and a final exercise period of 10 contractions at the rate noted in table 1. In groups I and VI, the load lifted was a 10 R. M. load, with the only difference between the two being the duration of the exercise program. In group V, the load was too great to be lifted, so that only isometric contractions occurred. In groups I and II, the average weight was similar, while the rate of contraction differed. In group III, the rate was similar to that in group II, but the load was increased. Finally, group IV performed exactly the same motion in exercise as was used in testing for reaction time. There were 10 contractions against the low resistance of 3.25 pounds. The right upper extremity was exercised in all instances, with one exercise period per day, five times weekly.

Results

Work Capacity: As seen in table 2, marked increases in endurance were produced with all the exercise programs. The rate at which this improvement occurred, however, seemed to vary. At the end of approximately three weeks of exercise, the gain was less with the low resistance complex motion exercise (IV) than with the high resistance programs (V and VI). At the end of approximately six weeks, however, there was no significant difference between the im-

Table 2: Effect of Exercise on Work Capacity

Type of Exercise	Initial Work Capacity Inch-Pounds	Mean Per cent Change 3 weeks	Mean Per cent Change 6 weeks	p
Low Resistance Complex Motion (IV)	2835	+78	+119	<.001
High Resistance Isometric Contraction (V)	2734	+120	+115	<.02
High Resistance Isotonic Contraction (VI)	1852	+109	+133	<.001

provement produced by the different exercise regimes, though the greatest effect was present with high resistance isotonic exercises (group VI).

Reaction Time: There was practically no change in reaction (table 3) time after the low resistance complex motion (IV). With high resistance isometric contractions (V) there was a slight average increase of 6 per cent in reaction time. This increase was of suggestive significance from a statistical standpoint. With high resistance isotonic contractions (VI), however, there was an average increase of 12 per cent in reaction time. This also was statistically

Table 3: Effect of Exercise on Reaction Time

Type of Exercise	Initial Reaction Time Milliseconds	Mean Per cent Change 6 weeks	p
Low Resistance Complex Motion (IV)	353	+2	.6
High Resistance Isometric Contraction (V)	332	+6	<.1
High Resistance Isotonic Contraction (VI)	398	+12	<.05

significant. It should be noted, however, that the control values were 13 per cent smaller in the high resistance isotonic group (VI) than in the low resistance complex motion group (IV). The significance of this observation is analyzed further in the discussion.

Isometric Tension: Marked and significant increases in tension were produced by high resistance exercises at the slower rate of 10 contractions per minute, even after only two weeks of exercise (table 4). At the faster rate of 30 contractions per minute, however, there was no significant increase in isometric tension at the end of 4 weeks of exercise. When the rate of contraction and the duration of exercise are the same, the isometric contraction (V) was slightly better than the isotonic one (VI), though the difference between the two was not significant (table 5). The low resistance complex motion (IV) resulted in no increase in isometric tension after two weeks; a small but significant increase was evident after 6 weeks of exercise. This increase was significantly smaller than that produced by the high resistance exercises (table 5).

Relation: In order to determine whether there is some relation between control levels of endurance, reaction time, and isometric tension, scatter diagrams were prepared and correlation coefficients were computed. From these diagrams and the accompanying correlation coefficients (fig. 4, 5, 6) it may be noted that there is a fair to good correlation between isometric tension and work capacity, a less than fair correlation between isometric tension and reaction time, and no correlation between

Table 4: Effect of Exercise on Isometric Tension

Type of Exercise	Initial Isometric Tension, Pounds	Mean Per cent Change	p
High Resistance Isotonic-slow rate, 4 Weeks (I)	24.1	+20	<.001
High Resistance Isotonic-rapid rate, 4 Weeks (II)	23.6	+6	>.1
High Resistance Isotonic-rapid rate, 4 Weeks (III)	24.8	+8	<.1
Low Resistance Complex Motion, 6 Weeks (IV)	21.1	+11	<.05
High Resistance Isometric-slow rate, 6 Weeks (V)	21.0	+35	<.01
High Resistance Isotonic-slow rate, 6 Weeks (VI)	21.8	+27	<.001

work capacity and reaction time.

Similar studies carried out for changes in the various aspects of neuromuscular function produced by exercise showed no correlation between any of the parameters. There is no relation, for example, between the amount of improvement in isometric tension that may be produced in any subject by a given exercise and his improvement in work capacity or in reaction time.

Effects: Although effects on the contralateral unexercised extremity were not subjected to careful scrutiny in this study, some observations were made on the effect of exercise on isometric tension of the "unexercised" wrist flexors. This was done for groups I, II, and III. The respective increases in isometric tension after 4 weeks of exercise were

Table 5: Comparison of Improvement in Isometric Tension Produced by the Different Exercise Programs

Groups Compared	Increase in Isometric Tension, Per cent	p Value for the Difference Between the Mean Percentage Change
I	20	
II	6	<.02
I	20	
III	8	<.05
II	6	
III	8	.7
IV	11	
V	35	<.05
IV	11	
VI	27	<.05
V	35	
VI	27	>.3

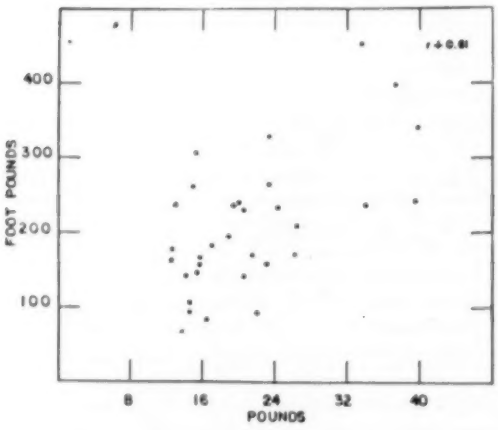

Fig. 4 — Scatter diagram showing the relation between the initial endurance (ordinate) and the isometric tension (abscissa). The figure in the upper right hand corner is the correlation coefficient.

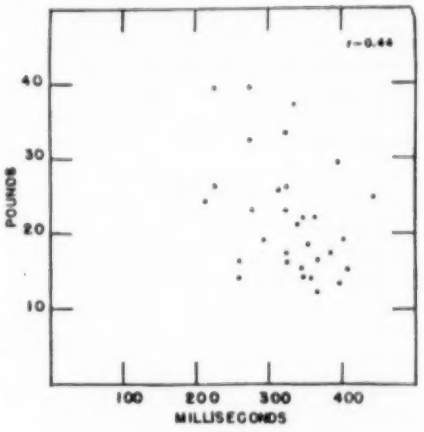

Fig. 5 — Scatter diagram showing the relation between the initial isometric tension (ordinate) and the reaction time (abscissa). The figure in the upper right hand corner is the correlation coefficient.

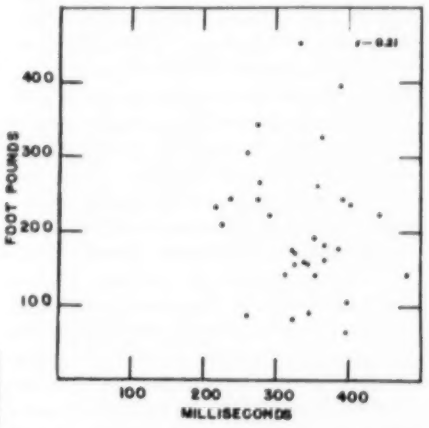

Fig. 6 — Scatter diagram showing the relation between the initial endurance (ordinate) and the reaction time (abscissa). The figure in the upper right hand corner is the correlation coefficient.

9 per cent, 2 per cent, and 8 per cent. The 9 per cent increase, with high resistance isotonic exercise at a slow rate (I), was of borderline significance; the other two values were of no statistical significance.

Discussion

Isometric Tension: It is readily apparent that neither total work done nor power, in the physical sense (work per unit time), is a major factor in determining the improvement in isometric tension after exercise programs. The average daily work performance in groups I, II, and III was 1430 inch pounds, 1380 inch pounds, and 1710 inch pounds, respectively, while the power, in inch pounds per second, was 23.8, 69.0, and 85.5, respectively. Yet, only in group I (high resistance isotonic contraction at a slow rate) did a marked and significant increase in isometric tension occur, despite the fact that the work done was the same as in group II and less than in group III, while the power was far less than that developed in either group II or III.

The common denominator which can explain the improvement in isometric tension may be the tension developed by the muscle during the exercise. It has been shown that the tension which a muscle produces during contraction decreases as the speed of shortening increases.[8-9] This is true for the human muscle as well as the isolated frog muscle. This pheonomenon has been related to the manner in which energy is liberated during contraction.[5,10]

Thus, in the isotonic contraction exercises, the greatest tension is developed at the slower rate of contraction than at the faster, thereby establishing a condition which is conducive to greater improvement in isometric tension. From this standpoint, the controlling factor in improvement in isometric tension would be the tension developed by the muscle during the training period. If this is true, then the tension development should be greater in a "zero-velocity" shortening[8] — the isometric contraction —and the improvement in isometric tension should be even better than with heavy resistance isotonic exercises. The comparison between groups V and VI was made with this in mind. Although the isometric contraction group did have more improvement than did the isotonic group, the difference was not a significant one.

The question arises as to why the improvement in isometric tension was not even greater following the isometric exercises, and whether such a small difference between isometric and isotonic contractions warrants use of the isometric exercise for the development of this particular function. It is possible that part of the explanation may lie in the failure of the isometric contraction group to exert maximal effort at all times. Although it is easy to check maximal effort in the isotonic group, in terms of motion through complete range, this was not possible in the isometric group. Until some simple means is devised to insure such maximal exertion this might be a deterrent to clinical use of the isometric exercise. Furthermore, it is possible that too great a tension development during exercise might be undesirable because of the danger of exceeding the elastic limit of the passively stretched elements in muscle.[20]

Endurance: Improvement in endurance has been related primarily to changes in vascular supply and in nervous patterns.[17-23] It has been stated that high repetition low resistance exercises are desirable in order to provide maximal increase in work capacity.[8] None of the exercises used in this study ideally fulfilled this requirement since the number of contractions was not greater than twenty, including the warm-up period. Of those exercises used, it could not be said that any had a specific influence on those factors which are responsible for improvement in work capacity, for all markedly and significantly increased endurance. It certainly seemed as if those mechanisms responsible for improvement in endurance were more easily and non-specifically affected than were those implicated in isometric tension improvement.

Reaction Time: Although maximal contraction of one muscle certainly results in activity in other muscle groups as well,[20-24] a rapid smooth movement of an entire extremity, which includes such different motions as wrist extension, pronation, extension at the elbow, and elevation of the arm requires an integration of activity which may be called coordination. Those who are trained for such a specific task, as were the subjects in group IV, might be expected to do better from this standpoint than those who emphasize but one muscle group (groups V and VI). At first glance this might be the conclusion one would come to as a result of this study, since the reaction time was increased significantly with high resistance isotonic exercises; moderately, though not significantly, with high resistance isometric exercises; and not at all with complex motion exercises.

One factor must be taken into consideration, however, before attaching undue emphasis to these differences. Examination of the relation between the initial reaction time and the change in reaction time with exercise (fig. 7)

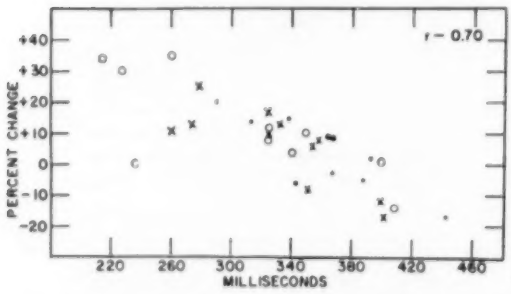

Fig. 7 — Scatter diagram showing the relation between the change in reaction time after exercise (ordinate) and the initial reaction time (abscissa). The figure in the upper right hand corner is the correlation coefficient.

shows a very good correlation between the two. The shorter the reaction time before the start of the exercise program, the greater is its prolongation after the exercise program was completed, independent of the type of exercise used. By chance, the high resistance isotonic exercise group (VI) started out with the shortest reaction time, while the complex motion exercise group (IV) had the longest reaction time. The former (VI) thus had an increase in reaction time with exercise. It is felt that no evidence is present concerning the effect of any specific exercise, per se, on reaction time.

It was suggested initially that "muscle function" was not a single simple phenomenon, but that there were various aspects, not all of which would respond in the same way to any given exercise. This was borne out by the correlation studies in which it was shown that before exercise there is a fair correlation between endurance and isometric tension, as would be indicated by the work of Hill,[8] but much less relation between endurance or isometric tension and reaction time. After exercise there was absolutely no demonstrable relation between the improvement in the various parameters studied.

Summary

Sixty-three normal subjects were subjected to isotonic and isometric exercises involving primarily the wrist flexors; and to complex exercises involving the entire upper extremity. The effect of these exercises on isometric tension, work capacity, and reaction time was studied.

Maximal increase in isometric tension was produced by isometric exercises at a slow rate (10/minute), although heavy resistance isotonic exercise at the same rate (10/minute) produced an increase in isometric tension which was almost as great. During the period studied, no significant increase in isometric tension resulted when the rate of exercise was increased to 30/minute, even when the load was the same or greater than in the slow rate exercise. The relation between tension development by a muscle and the velocity of shortening is discussed with respect to effect on isometric tension.

Marked increases in work capacity, ranging from +115 to +133 per cent, were produced by all the exercises used, whether heavy resistance isometric, heavy resistance isotonic, or low resistance complex motion.

Although an increase in reaction time followed the heavy resistance isotonic exercises, it was felt that there was insufficient evidence to attribute this change to the specific exercise. No significant changes in reaction time were produced by either the isometric exercise or the complex movement exercise.

Correlation studies showed no relation between the improvement produced in any one function by exercise, and that produced in any other of the functions studied.

For reprints, write Dr. Baer, Dept. of Physical Medicine and Rehabilitation, University of Colorado School of Medicine, Denver, Colo.

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Typewriter Reverse Feed Actuator for Quadriplegic Use

Earl Clifton

and

John H. Wagner, Jr., M.D.
Long Beach, Calif.

There is an average population of eighty quadriplegic patients in the Long Beach (Calif.) VA Hospital. Training these patients in the use of adapted equipment is an important part of their rehabilitation. This is especially true in the area of academic learning which normally requires the processes involved in writing or typing. Many patients can learn the processes involved in typing earlier and easier than the more complex operations involved in writing. While electric typewriters are easier to operate, the cost and bulkiness of the equipment militate against the general use of these machines by quadriplegics. In addition, the difficulty encountered by these patients in plugging such equipment into electrical outlets, makes the mechanically operated typewriter more suitable for their needs. However, because of the greater strength and range of motion required to operate the mechanical machine, it is oftentimes necessary to devise adaptive equipment for both patient and typewriter before typing can be accomplished. It was this type of problem which prompted this study.

A twenty-nine year old quadriplegic patient had learned to operate a standard typewriter with the aid of a special device constructed by the Occupational Therapy Department of this hospital. This device (fig. 9) has been named *wrist and finger stabilizer with striker attachment for flaccid hand*. The splint stabilizes the wrist and hand so that the forearm may be used as a stiff lever to bring the striker to bear on the typewriter keys. The striker is a simple plastic rod with a rubber tip.

This patient had good strength in both biceps and deltoids but with virtually no strength in the triceps. He was able to operate the keys of a typewriter by flexing his forearm with the biceps, holding the striker over the keyboard, and then relaxing the biceps to let the weight of the forearm and splint bring the striker down on the proper key. The deltoids and muscles about the shoulder girdle, which were partly functional, allowed enough movement at the shoulder joint to bring both the arm and forearm into proper position over the keyboard. With the aid of this device, the patient in time, became rather proficient at operating the keyboard of this standard typewriter. He was also able to operate the line space lever and thus move the paper in the normal direction against the platen. However, the reverse movement of the paper, which is ordinarily accomplished by grasping and turning the feed roll knob, could not be effected because of the weakness of the hand grip. Although such a deficiency seems of minor importance, the patient found that on the average of two or three times per letter it was necessary to go back to previous sentences to make corrections. This, of course, required the help of another person. It was, therefore, necessary to modify a standard typewriter so that the patient could overcome this deficiency and operate the machine independently.

Mechanical Description

The component parts of this actuator are shown in figures 5 through 8. Figure 1 shows the right end of a popular make of portable typewriter; figure 2 illustrates the same typewriter with the actuator installed; figure 3 shows the end

From the Physical Medicine and Rehabilitation Service, VA Hospital.

view of the installed actuator, and figure 4 is a side view of the assembled actuator, showing the plunger, spring actuator, dog and guide.

The feed roll knob was first removed by releasing the set-screw which secures it to the feed roll knob shaft. A center of machined brass was then inserted into a standard 30 tooth ratchet, allowing enough of a remaining hub to provide space for a set-screw. A hole, the diameter of the platen shaft, was drilled through the axis of the machined brass insert. Another hole to accommodate the set-screw for securing this assembled ratchet was then drilled and tapped in the brass hub.

The actuator housing shown in figure 5 was then constructed and machined. The size and shape of this part is determined by the make of machine for which this device is fashioned. The square hole running the length of the housing was made to provide a sliding fit for the plunger (fig. 7 and 8). The forward end of the square hole was then closed and a hole drilled in the closure to accommodate the threaded guide pin (fig. 6). A dog was then constructed of one-eighth inch carbon tool steel. After assuring its size and shape to be correct at the initial assembly stage, this dog was removed and hardened.

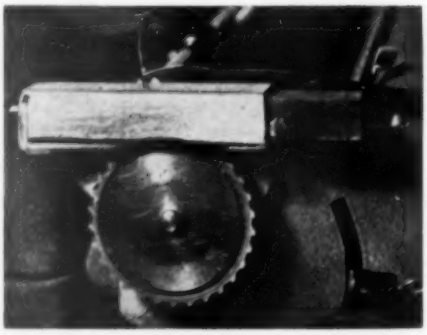

Fig. 3

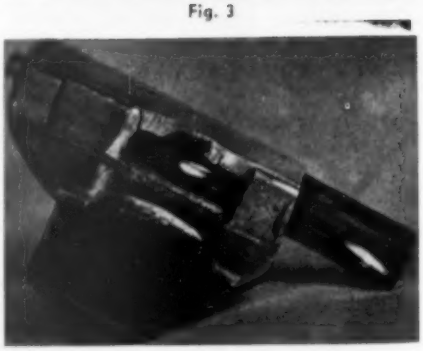

Fig. 4

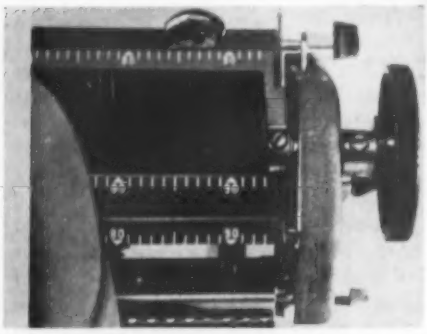

Fig. 1

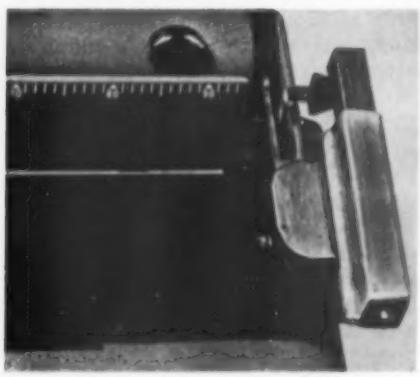

Fig. 2

A length of one-half inch square cold rolled steel was then cut to the desired length and the radial slot milled to recess the dog. The forward end was drilled and tapped #6-32-3 to accommodate the plunger. Following assembly of the dog and the plunger, the plunger was adapted to the square slot in the housing by draw filing. A compression spring five-sixteenths inch outside diameter by one-half inch long (12 turns per inch) was procured and the plunger machined (fig. 6).

The parts were then assembled and attached to the typewriter. It should be noted that this is done by using only

two screws: One through the hub of the ratchet to fasten the ratchet to the platen shaft, and the other through the housing on the end of the typewriter. Since this latter screw is merely a longer one than the one removed, no modification of the typewriter is made.

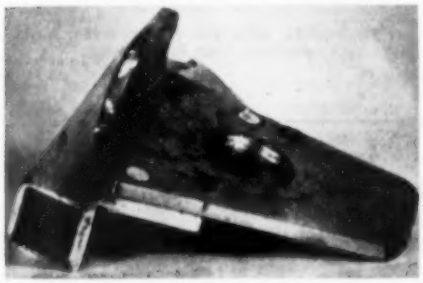

Fig. 5

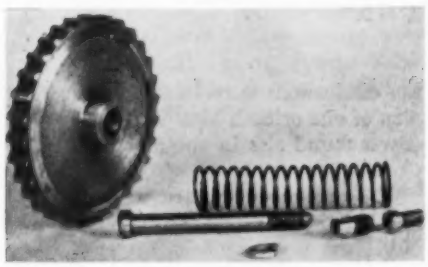

Fig. 6

Fig. 7

Fig. 8

To convert the typewriter back to its original condition, one screw must be removed, one screw loosened, and the original feed roll knob replaced.

The cost of material for this job is less than fifty cents. Construction time for a single unit will depend largely on tools and machines available.

In use, one must merely pull the plunger forward thus engaging the dog against the ratchet and turning the platen. On releasing the forward pull the spring will return the plunger to its original position. The device is simple

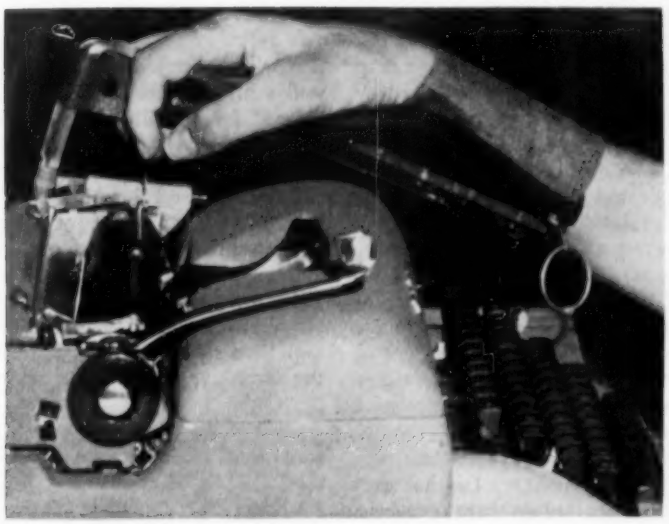

Fig. 9

to operate and is relatively trouble-free. Its limitation is that the number of spaces one can turn the platen on each forward motion of the plunger, is fixed.

The patient described was able to operate this device with the aid of the splint and striker (fig. 9). This enabled him to operate the typewriter independently and was a significant boost to his morale.

Summary

A simple attachment for a standard mechanical typewriter is described which made it possible for a quadriplegic patient to turn the platen in a reverse direction. This has enabled him to operate the machine without assistance.

For reprints, write Mr. Clifton, Manual Arts Therapy, VA Hospital, Long Beach, Calif.

Myositis Ossificans in Poliomyelitis: Two Case Reports

Kristian G. Hansson, M.D.
and
Olav Austlid, M.D.
New York City

It is well known that many types of heterotopic calcifications and ossifications exist and may be found in various tissues of the body.

Luck[1] makes a distinction between calcification and ossification, but the two processes are not always separable, since the deposition of calcium salts often is followed by the formation of new bone. The cases described belong to the latter type.

Ossification in muscles may occur under many conditions. Most often it is of traumatic origin and is characterized by the ossification of an organized hematoma in the region of a traumatized muscle.[1] The condition may be the result of repeated injuries to a muscle as seen in the development of bone in the hip adductors of riders (rider's bone or "drill" bone), or it may occur as a result of a single severe injury. Ossification in the quadriceps muscle may follow a heavy blow to the anterior aspect of the thigh or may develop in the elbow flexors as a complication of posterior dislocation of the elbow joint.

To our knowledge, myositis ossificans in acute anterior poliomyelitis has previously been reported on three occasions, entailing seven cases.[2] In six of these, the ossifications were located in the region of one or both hips. In three cases, it was found also in one or both shoulders.

The two cases reported were seen in the Hospital for Special Surgery, New York, the first one being in 1948, the other one in 1954. Both cases developed ossifying myositis in the region of the left hip.

Case One

A white, married woman, age 44, was well until July 16, 1948, when she developed fever, chills and stiffness of the neck. Six days later, she was admitted to Willard Parker Hospital where clinical findings and lumbar puncture revealed a diagnosis of acute anterior poliomyelitis with generalized paralysis and muscle stiffness. On September 2, 1948, the patient was transferred to the Hospital for Special Surgery. Examination here revealed marked weakness of the trunk and all four extremities,

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Associate Professor, Cornell University Medical School; Director, Department of Physical Medicine and Rehabilitation, Hospital for Special Surgery.

Assistant Director, Department of Physical Medicine and Rehabilitation, Hospital for Special Surgery.

mostly on the left side. There was also marked tightness of back muscles, hip flexors, knee and ankle plantar-flexors. The patient was treated daily with heat applied by hot packs and immersion in a tank. Stretching of all tight areas including the hip flexors and muscle re-education was given. On September 23, about ten weeks after the onset of her illness, the patient began to complain of pain and discomfort in the area of the left groin. On palpation, swelling and tenderness were noticed in the region of the upper antero-medial aspect of the left thigh. No known trauma had occurred while the patient was in the hospital. Two weeks later, on October 8, x-rays of the left hip revealed considerable lime deposits in the soft tissue on upper medial aspect of the left femoral shaft. Blood calcium at that time was 10.4 mg. per cent; phosphorous 4 mg. per cent, and alkaline phosphatase 4.6 Bodansky units. Urinary calcium was within normal limits. The stretching of the left hip was discontinued and the patient received daily microwave diathermy to the left groin. The pain decreased somewhat.

X-rays taken November 8, 1948, showed an increase in the deposition of lime salts and x-ray on February 21, 1949 showed a dense, ossified mass extending from the anterior inferior iliac spine to the femur a little below the level of the lesser trochanter. The pain gradually subsided, while motion in the hip became more restricted. During this time, the patient learned to walk in the parallel bars using a long leg brace on the left leg.

On December 8, about two and one-half months after development of the painful mass, passive hip flexion was blocked at 160 degrees. There were a few degrees of adduction and abduction and no rotation. During the next four months the motion in the left hip became even more restricted and the patient had difficulty sitting and walking. On May 4, 1949, the lower two-thirds of a bony bridge extending from the anterior superior iliac spine to below the lesser trochanter was resected surgically, measuring 3″ x 1¼″ x 1″. After the operation, the hip could be flexed to 120 degrees, a gain of more than 40 degrees.

X-rays taken three and six weeks after the operation showed recurrence of considerable amounts of lime deposits in the region of the lesser trochanter. The flexion in the hip, however, remained the same. The patient was discharged on June 30, 1949, and was later followed up in the poliomyelitis clinic. Since the time of discharge, there has been no change in either x-rays or motion of the left hip. The patient is now able to walk with a short spring brace on the left leg, using a cane on the right side.

Case Two

A white housewife, 25 years of age, mother of two children, contracted poliomyelitis on September 11, 1953. On September 15, she was admitted to Willard Parker Hospital. On the same day and the ensuing day, the paralysis spread rapidly to include all four extremities. Due to weakness of the intercostal muscles and restlessness, she was placed in a respirator for nine days.

On October 1, 1953, the patient was transferred to the Hospital for Special Surgery where examination revealed almost complete paralysis of both lower extremities and trunk muscles with less involvement of the upper extremities where most muscles were rated between poor and fair.

There was also generalized tightness of her musculature, especially of back muscles, hip flexors, hamstrings and calf muscles. Her treatment consisted of heat applied daily by hot packs and immersion in a tank. Stretching of all tight areas including the hip flexors was given. Muscle re-education was applied to the upper extremities.

On November 1, about one and one-half months after the onset of poliomyelitis, the patient developed pain and swelling in the left groin. The swollen area was soft, moderately tender to pressure and very painful when stretched. The passive stretching of this area was discontinued. During the next month the swelling subsided somewhat, but the

patient continued to complain of discomfort in the left groin, especially when the hip was flexed.

X-rays on January 6, 1954 showed several large deposits of lime anterior to the intertrochanteric area of the left femur. X-rays taken on April 9, 1954 showed the lime deposits in a lateral view. Laboratory data on January 27 showed the following: Blood calcium 11 mg. per cent; phosphorus 4.4 mg. per cent; alkaline phosphatase 5.6 Bodansky units. Urinary calcium was within normal limits.

X-rays on May 24 (fig. 1) showed the calcific deposits to be largely organized and to have the structure of bone.

Fig. 1

The patient continued to complain of pain in the left groin especially in the sitting position and on flexion of the hip. The patient's trunk muscles and lower extremities continued to remain essentially flail and she was unable to walk.

On June 16, 1954, the bony mass was resected surgically. The pathological report of the resected bone was as follows: Proliferating bone partly preformed in cartilage. The process is consistent with myositis ossificans.

X-rays on June 18, 1954 (fig. 2) showed the left hip after resection of the osseous deposit. Postoperatively the hip could be moved through full range without pain.

Fig. 2

Conclusions

Many theories exist to explain the development of myositis ossificans. The two most commonly mentioned are: (1) The new bone develops from traumatized periosteum of adjacent bone, and (2) the new bone develops from metaplasia of fibrous tissue.

Changes in the blood chemistry which could aid in the explanation of ossification were not found in the polio patients reported. In our two cases and in three

cases reported by Costello and Brown[3] in 1951, the blood serum calcium, phosphorous and phosphatase were normal. However, these findings were noted after the x-rays revealed calcium deposits. In two of the three cases reported by Freiberg[2] in 1952, the phosphatase level was elevated during the ossification period. This, he believed, was due to increased osteoblastic activity during the ossification process.

Costello and Brown[3] came to the conclusion that the atrophy and degeneration, given the added stimulus of trauma, could give a suitable condition for metaplastic ossification.

Hess[4] in his report on one case in 1951 thought that the likeliest cause was trauma from over-zealous stretching in the treatment of paralysis.

When comparing our two cases with those earlier ones which were reported with sufficient data, there are three factors they all have in common:

(1) They were all severely involved patients with marked muscular weakness and atrophy;

(2) the swelling and pain started at a time when they received passive stretching of tight areas, and

(3) the calcification occurred early in the disease.

This might suggest that passive stretching, even though done by trained therapists in the beginning of severely involved poliomyelitis patients, may cause tearing of the weakened and denervated tissues with resulting hemorrhage and calcification. Even though few cases have been reported to date, it seems that the areas about the hips and those of the shoulders are the ones most likely to become involved.

It is possible that myositis ossificans in poliomyelitis occurs more frequently than is known at present. Thus, in the one case reported by Hess,[4] the myositis was found accidentally when the patient fractured a femur and x-rays were taken.

Summary

The purpose of this study is to make one cognizant of the fact that whenever a polio patient develops pain and decreased motion especially in the hip or shoulder during the early period of passive stretching, one should consider the possibility of hemorrhage with subsequent ossifying hematoma.

For reprints, write Dr. Hansson, 525 E. 68th St., New York, N.Y.

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The Contribution of Sister Elizabeth Kenny to the Treatment of Poliomyelitis

Miland E. Knapp, M.D.
Minneapolis

The Elizabeth Kenny Foundation was established in 1943 for the purpose of improving the treatment of poliomyelitis throughout the world. At that time, a hospital had been established in Minneapolis devoted solely to the treatment of that disease. The medical profession was interested in this hospital because it was felt that the treatment of poliomyelitis was entirely inadequate and that great improvements could be made. We had listened to Sister Kenny propound her theories and had watched her clinics and demonstrations on patients. We were convinced that at least some of her methods would provide a means for improving the lot of the poliomyelitis victim.

Arrangements were made for her to treat a small number of patients at the Minneapolis General Hospital under our supervision. During this first season of acute poliomyelitis she treated twenty acute patients. She presented theories of sufficient interest and results of sufficient promise so that the experiment was continued. In the following year, we became convinced that the results obtained by her methods were better than any that we had been able to accomplish previously. While Sister Kenny's background in pathology and medical training left much to be desired, she was an excellent clinical observer with keen perception and the ability to analyze what she observed in the light of an intimate knowledge of muscle function in all its details and a long experience in working with muscular disabilities.

After our first publication in 1941[1] Sister Kenny and her treatment method became the subject of many heated discussions in medical circles. With the zeal and enthusiasm of an evangelist, she tried to convert the medical profession to her way of thinking. This she found to be a difficult and often an impossible task. Her Irish temperament was such that although she dearly loved a fight, she could not brook opposition, and it was impossible for her to see any point of view other than her own. At the same time she was most impatient with those who disagreed with her. This type of attack naturally resulted in a continuous dissension between her and the members of the medical profession who would neither listen to nor embrace her ideas. Unfortunately, most of the arguments were published in the daily newspapers. From a medical viewpoint this was not good. It was extremely effective, however, in arousing interest in the subject of poliomyelitis. While Sister Kenny was annoyed with her snail-like progress, very few medical ideas have gained such rapid momentum and prestige and have affected the general treatment of a disease as completely as did hers.

"Abandonment of immobilization" has been accomplished to a large degree throughout the United States and probably throughout the world. In many instances, it is so complete that those who are now treating the disease have forgotten they ever employed prolonged immobilization.

In the past five years, under the wise leadership of Dr. E. J. Huenekens, the Elizabeth Kenny Foundation and Institute have made remarkable progress. The Kenny Institute is now affiliated with the University of Minnesota Medical School. Interns and residents from the University rotate through the Institute as part of their training. All the specialties particularly interested in poliomyeli-

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tis are represented on the medical staff. These include physical medicine, orthopedics, pediatrics, neurology, urology, otolaryngology, and psychiatry. The great majority of these doctors are also members of the University staff and many who were previously opposed to Kenny treatment have found that their opposition was personal rather than factual. A small research program has been established which is enlarging on a sound and conservative basis. Therapists are constantly being trained to carry out treatment under strict medical supervision. The therapist's training requires two years following a full three-year or longer nursing course or graduation from an approved school of physical therapy.

Sister Kenny propounded a concept of poliomyelitis which differs from the conventional one by emphasizing not the results of denervation, but other damaging effects of the disease which are more amenable to treatment. She presented a well-thought-out logical and physiological treatment for the symptoms as she saw them. Her concept varies from the conventional concept largely by a reversal of the interpretation of what is cause and what is effect. The conventional concept lays emphasis upon weakness resulting from the flaccid lower motor neuron type of paralysis which is present, and the deformities are conceived to be the result of differences in strength in antagonistic muscles. Contractures thus are a result of differentials in strength according to the concept of muscle imbalance. Sister Kenny, on the other hand, felt that deformities resulted not because of differences in strength but because of the persistence of muscle shortening following what she designated as muscle spasm. If muscle shortening could be overcome by treatment in the early stages, deformities should not develop or at least they should be minimized. She believed that certain of the paralyses resulted from a psychologic mechanism because of painful spasm or shortening of opposing muscles. She called this condition "mental alienation." Release of the spasm together with suitable muscle re-education was capable of restoring power to those muscles. Thus, she believed that weakness was not a cause of the muscle shortening, but that muscle shortening in some cases could be a cause of the weakness.

Pathology

Sister Kenny's ideas were not based on any pathologic concept of the disease. She had no pathologic background other than that she acquired from reading the literature. Her interpretation of the findings often was thought illogical by those doctors who had learned only the anterior horn-cell type of pathology. Recent studies have shown that the involvement in poliomyelitis is much more extensive than previously thought. Of course, it is well established that anterior horn cells, the large motor neurons directly innervating the muscle fibers, are often damaged or destroyed by the poliomyelitis virus. It is also agreed that when those cells are destroyed they never recover, since there is no regeneration within the central nervous system. This factor undoubtedly accounts for the permanent loss of muscle power.

However, it has now been shown by various investigators that many other areas of the central nervous system are also involved. A study[8] showed that involvement of internuncial cells occurs. Figure 1 shows the areas of the cerebrum, cerebellum, and brain stem most frequently involved in poliomyelitis. Upper and lower motor neurons may occasionally be involved in the same patient. We have treated one patient who has involvement of all four extremities. Three of these extremities are denervated with the usual flaccid, lower motor neuron type of paralysis. The fourth extremity has a typical upper motor neuron paralysis with hyperactive reflexes and marked ankle and patellar clonus.

Dr. A. B. Baker,[9] Chief of Neurology and Neuropathology at the University of Minnesota, has been able to demonstrate localized involvements in certain of the vital centers in the medulla and in certain layers of the cerebellum and cerebrum.

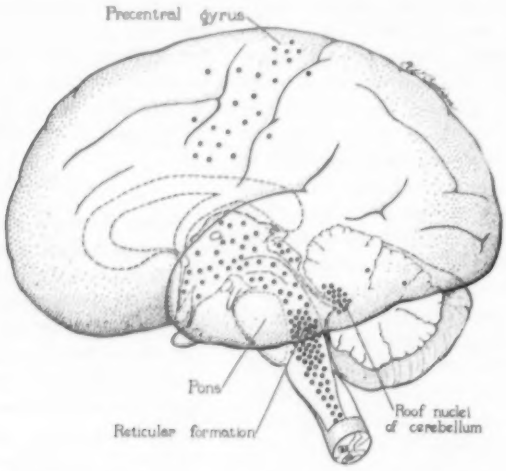

Fig. 1 — Lateral view of human brain, with schematic transparent projection of the midsagittal surface of the brainstem. General distribution of lesions of poliomyelitis is indicated by large dots. Lesions in the cerebral cortex are largely restricted to the precentral gyrus, and those in the cerebellum to the roof nuclei. Lesions are generally found widespread in the brainstem centers, with a number of striking exceptions, such as the nuclei of the basis pontis, and the inferior olivary nuclei. (Illustration reproduced through the courtesy of David Bodian, M.D., J. B. Lippincott Co., and the National Foundation for Infantile Paralysis, Inc.).

These studies have made it possible to explain some of the findings in poliomyelitis much more adequately than before. However, we still see many patients with puzzling symptoms and findings which defy explanation. There is still no absolute pathologic explanation for the muscle shortening or spasm which is almost routinely found in poliomyelitis. Doctors Laruelle and Ruemont[5] of the Neurological Institute in Brussels have shown some inflammatory findings in the muscle itself which may help to explain this phenomenon.

Treatment

Briefly stated, the principles of the conventional type of treatment before the advent of Sister Kenny were: During the acute stage of the disease, an attempt was made to prevent the development of contractures and to rest the affected parts by the application of splints or casts. This immobilizing apparatus was usually kept in place until muscle tenderness had disappeared. In the majority of cases, the duration of muscle tenderness was about six weeks. Sometimes it would last for six months or longer. At the same time, heat in some form was used to assist in the alleviation of pain. A commonly used form of heat was hot packs applied for one-half hour two or three times daily. These packs had a maximum temperature of 115 to 120 F. and were used only when pain was severe. When muscle tenderness had subsided, muscle re-education was employed. This re-education was based on the pathologic principle that there had been destruction of some of the anterior horn cells with resultant loss of function of the muscle fibers supplied by those cells. Therefore the patient was asked to carry out the motion of the weak muscle while the therapist carried out the motion of the strong muscle. Thus an attempt was made to strengthen the weak muscle at the expense of the strong muscle thereby restoring muscle balance. This type of muscle re-education obviously had little

to do with actual education and is more accurately described as localized exercise, since we were attempting to strengthen certain weak muscles.

In contrast to this type of treatment, since the Kenny concept considers muscle shortening as a positive entity and one of the important direct effects of the disease itself, the Kenny treatment carried out vigorous, active efforts to overcome this muscle shortening or "spasm." Hot packs are applied intensively. These packs are not the same as the hot packs previously described. These packs are intended to produce both vascular and muscular reflex stimulation. The packs are extremely hot but are carefully prepared to avoid the presence of droplets of moisture which would cause burns. We have carried out experimental work which showed that the packs may be applied at temperatures of 140 to 145 F. without causing burns. An exact technic must be used in order to accomplish this. As we do it, the packs are boiled and then transferred directly to a centrifugal extractor, or, if such equipment is not available, to a wringer where it is wrung out twice so that all droplets of water are removed. The pack is then immediately applied without allowing any time for cooling. As a result, the patient squirms when the pack is applied. In my opinion, the pack will not be efficient unless it is so hot that the patient *does* squirm when first applied. Skin temperatures are elevated by this type of pack as shown in figure 2. This type of pack, of course, cools off very quickly so that the temperature of the pack which was about 140 F. at the time of application quickly cools off so that it is only a few degrees above body temperature at the end of four or five minutes although the best technic is employed. This is desirable because

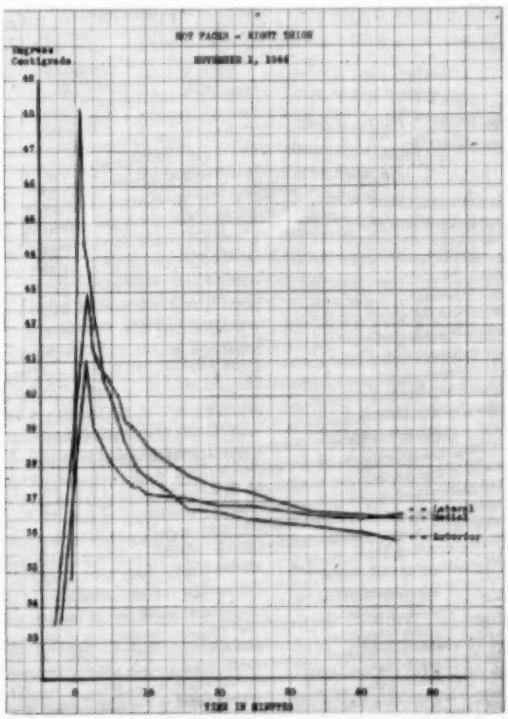

Fig. 2 — (Reproduced through the courtesy of F. J. Kottke, M.D., Minneapolis).

this type of hot pack is *not* really a heat application. No attempt is made to keep the pack warm with hot water bottles or other heating apparatus; we feel that the reflex stimulus due to the sudden change in temperature is the reason for its effectiveness. The pack is not intended to and does not affect the amount of denervation present in the spinal cord. It cannot overcome the neurologic destruction caused by the disease. It is given only to relieve the muscle shortening and to increase the vascularity of the extremity.

The packs are changed frequently depending upon the condition of the individual patient. In cases of extreme spasm, as evidenced with opisthotonos, the packs may be changed as often as every five minutes. At the same time the patient is so placed that the muscles are in as relaxed a position as possible. Instead of trying to overcome the deformity by force, the deformity is overcome by relief of tightness and relief of pain. If pain is aggravated, the deformity will be aggravated.

If the spasm is less intense, the packs are applied less frequently and are changed perhaps every half-hour, hour, or two hours. Packing is continued through the major part of the day, ordinarily at least eight hours daily instead of one-half hour two or three times daily.

No splints, casts, or braces are used during this acute stage of the disease. At the same time motion is usually carried out in connection with methods of muscle re-education. These motions are performed passively and very carefully so that pain is not produced. Pain would tend to increase the muscle spasm. I would like to emphasize the fact that hot packs alone will not relieve muscle shortening. Unless accompanied by motion, tightness will remain. As soon as attempts at muscle re-education can be carried out without aggravation of spasm, the procedure is started. Frequently this can be done as early as a day or two after the onset of the disease. The treatment is usually started while the patient is still in isolation and sometimes when fever is still elevated.

Stages of Re-education

The type of re-education advocated by Sister Kenny and systematized by her seems to be a very logical and physiological method of treatment. It really deserves the title of "re-education." When analyzed from a physiologic point of view, it consists of three fundamental procedures which are carried on more or less simultaneously.

The first procedure is carried on at a reflex level and consists primarily of motion of the affected part without any conscious effort on the part of the patient. Sister Kenny gave this procedure the name of tendon stimulation. When it is successful, the tendon of the weakened muscle will be seen to stand out when the part is being moved passively in the direction that the muscle would ordinarily move it actively. This, of course, is actually the demonstration of a proprioceptive reflex including the motor part of the arc and indicates the presence of some motor neurons although there may be no voluntary ability to contract the muscle.

The second stage was called "restoration of mental awareness," and consists of procedures intended to make the patient aware of the function that the individual muscle or muscle group should perform. Every available method of making the patient aware of this function is used. The insertion of the muscle is stroked by the therapist thus providing tactile stimuli. The motion is carried out passively, thus providing proprioceptive stimuli. The patient is told the function of this muscle, its origin and insertion, and other anatomic characteristics thus providing auditory stumuli; and at the same time the patient sees the motion carried out, thus providing visual stimuli. This is then, an attempt to re-educate the afferent portion of the motor pattern. It is, of course, a very complex affair involving the contraction and relaxation of many muscles—stabilizers, agonists, antagonists, synergists, etc.—and involves many more muscles than the one for which the re-education is being given.

The third stage of re-education was

called by Sister Kenny the "restoration of muscle function," and now for the first time the patient tries to perform the desired motion. If he is successful in carrying out the motion, the treatment is immediately stopped to leave the patient with a sense of accomplishment. It is important not to tire the patient so that the function cannot be performed and thereby discourage him. The psychologic effects are extremely important because the patient must produce great effort to carry out these functions as effectively as is possible. The treatment is then repeated the following day and gradually built up to the point where the patient can carry out as effective and useful function as is possible. Again this re-education of the motor side of the motor pattern involves the use of many neurons and many muscles and is a most complex affair. Luckily for the therapist and the patient, we do not need to know specifically all of these accessory functions, since the process of learning consists of the breaking down of resistance at the synapse by repetition of movement so that pathways are developed down which the impulse may pass automatically and without voluntary effort. Thus the therapist and the patient need only to produce the desired movement of the part, first passively and later actively, in order to re-educate these pathways to coordinated function. A great deal of repetition and time is required for this type of treatment. It cannot be expected that recovery will occur immediately or with a minimum of effort, since training of any kind requires much time. With the weakened muscles of poliomyelitis it is even more necessary that hours of treatment be carried out persistently, energetically, and hopefully in order that the best results may eventually be obtained.

In this type of re-education, emphasis is placed not upon strength but upon coordinated, rhythmic function, because it is felt that coordination is much more important than strength in daily life. While strength is desirable, of course, I would much prefer to have great coordination with little strength than to have little coordination with great strength. This method of re-education, then, has for its objective not the development of muscle power in weak muscles exclusively, but rather the development of a comprehensive motor pattern in which both the strong and the weak muscles work coordinately for maximum efficiency. It does not restore life to dead nerve cells. Even Sister Kenny never has claimed that such restoration could be accomplished by any method of treatment. Because there is no regeneration within the central nervous system, denervation is permanent. The purpose of the treatment is to obtain maximal coordinated, rhythmic function within the limits imposed upon the patient by the weakness caused by denervation. Effort should be made to obtain maximal function in spite of weakness and to help prevent contractures and deformities by removing the causes for contractures, both in the acute stage by the use of hot packs and motion and in the late stage by carrying on rhythmic function which does not promote the development of late contractures.

Under this concept and treatment for the disease it is obvious that we try to avoid braces wherever possible. Reasons for this are numerous. When a brace is used it becomes part of the motor pattern and often it is difficult to educate the patient out of the appearance of using a brace even though the brace has been removed. Use of a brace interferes with use of certain muscles so that their effectiveness is lost and their likelihood of strengthening is lessened because they are used infrequently. Of course, braces are used when necessary and not infrequently the use of a brace makes ambulation possible where, without the brace, ambulation is impossible. At such time, the brace becomes part of the patient's functioning mechanism and helps, rather than hinders, the development of maximal functional usefulness. In some cases braces may be successful in helping to prevent the development of contractural deformities. However, this usefulness is very limited since most braces do not prevent deformities and in almost

no instance do they correct deformities. Many patients even with extreme weakness may function much more efficiently without than with a brace. Bracing should not be done just because weakness is present. I am of the opinion that bracing is not necessary to protect weakened muscles. And in nearly all instances bracing should not be done early but should be done only after muscle tightness has been overcome quite thoroughly and it has been found that a brace is necessary for practical function.

Orthopedic surgical procedures and rehabilitation methods are very important in the late care of poliomyelitis. They are merely mentioned here because they are not a definite part of the Kenny treatment which is designed primarily for the early cases. If early Kenny treatment has been adequately performed, the majority of operations should be those that are done because of muscular weakness rather than because of contractures. The rehabilitation should be more rapid and more complete because of the lessened incidence of contractures and deformities.

Especially in the severely paralyzed quadriplegic type of patient and in those who have been in respirators, the problems of rehabilitation may be very great. In these patients the ordinary considerations of treatment are all superseded by the necessity for keeping the patient alive and attempting to give him some slight degree of usefulness. However, persistent efforts should be made for a long period of time to obtain functional usefulness even in these patients. This does not necessarily require prolonged hospitalization. Many of these procedures can be carried on for long periods of time in the home. But neither the doctor nor the patient should give up hope for several years after the onset of poliomyelitis, because it has been my experience that these patients continue to improve almost indefinitely if they are made functional to some degree.

Results

In 1952 a survey was published of the cases which have been treated by the Kenny method in the acute stage between the years 1940-1945.[6] This survey shows that the functional ability of the patient was rather great and that the number of patients requiring bracing or other aids or surgical treatment was fairly low. This is particularly important since these patients were followed up from five to more than ten years permitting late complications to be included in the series.

This study covered 478 patients admitted less than four weeks after the onset of the disease. Follow-up information was obtained in 391 or 81.8 per cent of the cases. They were functionally classified in four grades.

Table 1: Time from Onset to Admission (in weeks)

	1	2	3	4
Total patients followed	210	118	39	23
% Operated	2.3	6.7	7.8	8.7
% With Scoliosis	0.4	2.5	7.7	4.3
Living Spinal Paralytic Patients	101	84	26	17
% Operated	4.9	9.5	11.5	11.8
% With Scoliosis	0.98	3.5	11.5	5.9

The end results were as follows:

Grade 1	156	45.1%
Grade 2	83	24.0%
Grade 3	78	22.5%
Grade 4	29	8.3%

Thus approximately 70 per cent of the patients became essentially normal, and 30 per cent were left with varying degrees of residual disability. Of the 107 patients with residual disability 8 or 2 per cent use a wheel chair for practical locomotion. Two are able to walk with braces and crutches, and two can walk without braces with sticks; five patients use two long leg braces, and six use one long leg brace. Eighteen patients have undergone surgical procedures. Scoliosis of clinical degree developed in eight patients or 2 per cent of the series. One patient had a spinal fusion performed.

The value of early treatment is indicated by the comparison of the cases when grouped according to the weeks from onset of the disease to admission for treatment (table 1). This shows a steady increase in the percentage of cases which required eventual surgery

and in those which eventually developed scoliosis if treatment were delayed. It would appear from these figures that the first three weeks of the disease are the most critical at which time treatment can prevent serious late complications.

Conclusion

With the passing of Sister Kenny it is possible to evaluate her contributions to the field of poliomyelitis in an objective manner without many of the emotional reactions her name frequently introduced.

It is my belief that Sister Kenny has made at least three important contributions to the subject of poliomyelitis.

She has emphasized muscle shortening as a cause of deformity, and has pointed out that this shortening is not secondary to anterior horn cell damage, but is a positive entity which requires positive treatment in the early stages if future deformity is to be minimized.

She has systematized a technic of muscle re-education which really deserves the name of "re-education" and which is based upon sound physiologic principles and logical reasoning.

She has emphasized a positive approach to the treatment, laying stress upon those things which can be treated with some hope of success such as muscle shortening, reversible paralyses and incoordination, and relatively ignoring those things for which no treatment is successful, namely, anterior horn cell degeneration with motor denervation.

It is my hope that further research will shed light upon the pathologic and physiologic mechanisms for these conditions so that future treatment may be improved, and particularly that prevention may be made practical or that some cure may be found so that this dread disease need no longer be feared by generations to come.

For reprints, write Dr. Knapp, 920 S. 7th St., Minneapolis, Minn.

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Cervical Syndrome Especially the Tension-Neck Problem: Clinical Study of 800 Cases

Edward M. Krusen, Jr., M.D.
and
Ursula Leden Krusen, M.D.
Dallas

Many articles have been published discussing physical therapy for protruded cervical intervertebral discs. A recent report by Martin and Corbin[1] on sixty-one such cases includes an excellent review of the literature on this subject. It has been felt for some time that proved discs comprise only a very small percentage of the cervical problems seen in a general physical medicine department, and for that reason we decided to analyze 800 cases of complaints referable to the cervical region, which were seen in approximately three years. All these cases were initially classified under a common diagnosis as "Cervical Syndromes" and then subdivided into various entities for analysis.

Symptoms and Findings Common to Cervical Syndrome

Symptoms and findings, with certain exceptions to be mentioned, were remarkably similar for all patients. The two most common symptoms in this entire series were headache and neck and shoulder pain. These were not necessarily associated. Headache was usually occipital, but often involved temporal or parietal regions. It might be constant or occur in sharp twinges but in most cases it was described as "unbearable." Pain, paresthesia, weakness, and sensory changes in the arm were also common symptoms. Less common were face pain, earache, blurring of vision, dizziness, and chest pain. Often definite psychogenic symptoms were present, such as globus hystericus, gastric upset, fainting spells, and general anxiety state.

Findings usually included tense neck muscles with limitation of rotation, lateral bending and flexion. Tender areas were present in a high percentage of cases and were either nodular or in the form of rigid strands. X-rays frequently showed reversal of the normal lordotic curve with limitation of motion of a portion of the cervical spine and often gave the appearance of a subluxation.

Analysis of Cases

All patients fell into one of two main groups: Those with a history of relatable injury (328 patients), and those without injury (472 patients). These two groups were in turn broken down into injuries of four types.

1. *Automobile accidents* (139 *patients*): These injuries were mostly of the whiplash type. This usually occurred when a car was hit from the rear, thereby straining the patient's neck muscles.

2. *Direct injuries to the head and neck* (94 *patients*): The majority of these injuries were sustained while the patient was either at work or engaged in sports activities.

3. *Falls* (49 *patients*): The greatest number of these injuries was found among construction workers resulting from falls off scaffolds of varying heights.

4. *Indirect injuries* (46 *patients*): These were caused in numerous ways and were often quite unusual. For example, one lady caught the feather of her hat in a door; one man hurt his neck when his finger was strenuously jerked, and another was butted by a ram.

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From the Departments of Physical Medicine and Rehabilitation, Baylor University Hospital and Southwestern Medical School of the University of Texas.

The time elapse between the injury and beginning of treatment varied from one day to several years. Many patients gave a long history of mild intermittent pains which were greatly aggravated by the injury. We feel that the complaints were not necessarily caused by the injury in all cases in this group, but in each case the patient was convinced that the injury was responsible for his present discomfort. Of course, most cases in this group were compensation cases involving insurance, and many others had definite psychogenic features following the injury. An extreme example is that of a woman who developed headaches after she was beaten over the head by her husband. It was interesting but not too surprising to note that of 328 cases, only fifty-seven or eighteen per cent had associated demonstrable injuries such as fractures.

The 472 patients without history of injury were divided into five groups:

1. *Acute cervical fibrositis or myositis* (88 *patients*): The typical history in this type of case was one of cervical symptoms occurring for only a short time before treatment was started. Frequently there was drawing of the head to one side. The episode was usually described as a "crick in the neck" by the patient. Results for this group are discussed separately since treatment time and prognosis were found to be entirely different from all other groups.

2. *Advanced cervical osteoarthritis* (30 *patients*): This group included only patients with appreciable hypertrophic spurring and narrowing of the intervertebral discs as revealed by x-ray. Most of these patients had radicular symptoms aggravated by neck extension. Obviously this group would have been much larger if all patients with minimal osteoarthritis had been included.

3. *Scalenus syndrome* (13 *patients*): The main complaint in these patients was paresthesia and pain along the ulnar aspect of one or both arms with varying degrees of cervical symptoms. Scalenus maneuvers were positive in all cases, and some also had typical cervical ribs.

4. *Cervical disc* (24 *patients*): Protruded intervertebral discs were diagnosed only if typical symptoms were accompanied by demonstrable organic findings, such as weakness, atrophy, sensory changes of radicular type, reflex changes if the appropriate dermatome were involved, and preferably changes in the myelogram. These objective changes were considered of paramount importance in making a definite diagnosis. Pain and paresthesia down the arm associated with neck limitation, cough and sneeze effect, functional weakness and sensory changes were found not to be pathognomonic of cervical discs. When myelograms were performed in such patients for reasons of compensation claims, many were found to be negative. Therefore, these patients were included elsewhere and not considered in the disc category.

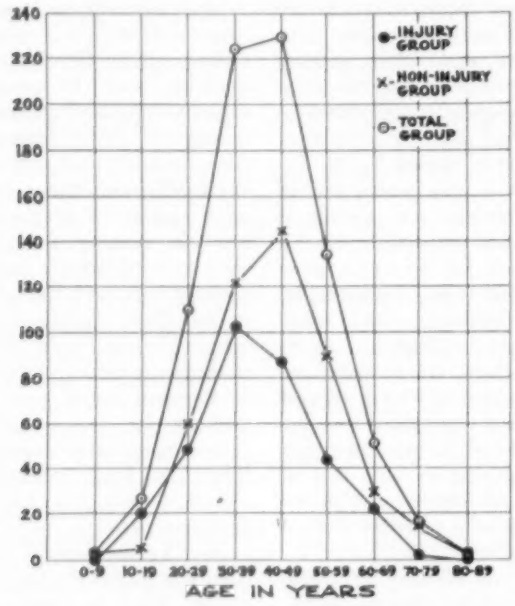
5. *"Tension neck"* (317 *patients*): This was by far the largest group in the entire series. In these patients typical cervical symptoms were associated with environmental factors producing tension. No attempt was made to psychoanalyze the patients, but many of these factors were volunteered by the patient or discovered on routine questioning.

Age and Sex Distribution

Age distribution is shown in graph 1. The distribution curves were very similar for injury and non-injury groups, with a definite sharp peak between thirty and fifty years of age. As a matter of fact, fifty-seven per cent of all patients in the series were in their thirties or forties.

Sex distribution is shown for the main groups in graph 2. There were roughly sixty per cent women and forty per cent men in the group. In the injury group there were more men than women. This was especially true for direct injuries which involved more than twice as many men as women. Automobile accidents were the only type of injury which included more women than men.

In contrast, the non-injury group shows seventy per cent women to only thirty per cent men. This difference was most marked in the tension group where



Graph 1 — Age distribution showing number of patients in each decade for the main groups.

women outnumbered men by more than three to one.

Method of Treatment

Treatment for cervical syndrome consisted of the application of heat, usually shortwave or microwave diathermy for thirty minutes, and deep stroking and kneading massage. If tolerated, frictional massage was also included. Except in acute cases, this was followed by vertical traction according to Hanflig's method;[2] that is, starting with approximately thirty pounds and increasing the amount gradually. All patients were given supervised active neck exercises. Particular stress was placed on rotation and lateral bending, with avoidance of extension. In addition, some patients received stimulation by a tetanizing current from a low-voltage stimulator in an effort to relax the tense neck muscles.

Evaluation of Treatment

Results were analyzed according to the degree of improvement in relation to the type of case, to the duration of the complaint before treatment, and to the duration of treatment. Average treatment times were also determined. Degree of improvement was defined in one of three ways: 1) Good improvement—this required marked or complete relief of symptoms with corresponding improvement in objective findings; 2) slight to moderate improvement—this signified a variable amount of subjective relief, but a definite change in objective findings, and 3) no improvement.

A number of patients in each group of this series was not available for evaluation of final results. Included were patients sent to the physiatrist primarily for diagnostic or disability evaluation, persons instructed in home treatment, and patients who discontinued treatment themselves before evaluation could be made. To avoid confusion, these cases were omitted from the statistical analysis.

Improvement in Relation to Type of Involvement

The degree of improvement for the main groups is shown in graph 3. When the acute fibrositis group was analyzed separately, the results for the remaining non-injury group were remarkably sim-

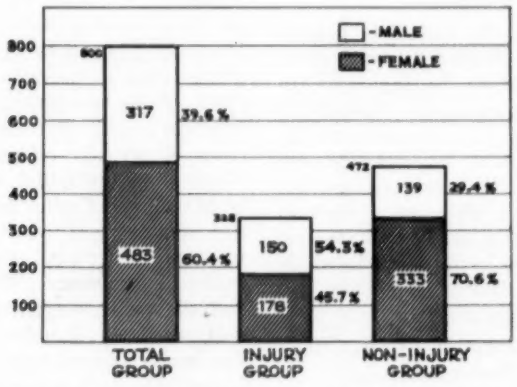
ilar to those of the injury group. In the injury group, there was 40.3 per cent good improvement, 47.1 per cent moderate improvement, and 12.6 per cent no improvement. In the non-injury group, there was 41.9 per cent good improvement, 38.5 per cent moderate improvement, and 19.6 per cent no improvement.

Results for the subdivision of these two main groups excluding fibrositis were essentially similar to these averages. They were analyzed individually, but the figures are not included because some of the groups were too small to be significant.

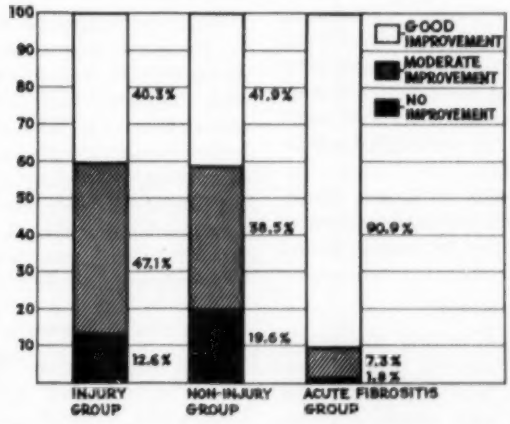
In marked contrast to approximately 40 per cent good improvement in these groups, there was 90.9 per cent good improvement in the fibrositis group. The percentage for moderate and no improvement was correspondingly lower than in the other groups—7.3 per cent moderate improvement, and 1.8 per cent no improvement.

Average and Mean Treatment Times

Determination of the average and mean treatment times further demonstrated this difference in results. For the injury group, treatment time varied from a few days to more than one year. Average treatment time was four to five weeks, and mean treatment time was three to four weeks. At the end of five weeks (the average treatment time),



Graph 2 — Sex distribution showing number and percentage of men and women for the main groups.



Graph 3 — Degree of improvement in per cent showing acute fibrositis as a separate group.

68.4 per cent of patients had been dismissed.

For the non-injury group, treatment time varied from a few days to 34 weeks. Average treatment time was three to four weeks, mean treatment time two to three weeks. By the end of four weeks, 75.4 per cent of patients had been dismissed.

For the acute fibrositis group, duration of treatment was measured by individual treatments rather than in weeks. Treatment time varied from one to twenty-nine treatments. Average treatment time was 7.7 treatments, mean treatment time was 5 treatments; 62 per cent of patients were dismissed at the end of 8 treatments.

Improvement in Relation to Duration of Complaint

The effect of the time elapsed from the onset of the complaint until treatment was started on the degree of improvement was minimal. Contrary to our expectations, there was no striking difference in results. Improvement was slightly better in the group treated less than one month after onset than in those treated from one month to one year later. Results in the group in which treatment was started more than one year later were slightly worse.

Improvement in Relation to Duration of Treatment

The effect of the duration of treatment on the degree of improvement was also insignificant. Again, there was no marked difference in results. There seemed to be no optimal treatment time. The percentages of the different degrees of improvement obtained in later weeks were quite similar to those obtained for the first few weeks.

The acute fibrositis group was not included in these last two analyses because of the short duration of complaint and short treatment time.

Comment

One of the most striking findings in this entire study was the dramatic response of acute fibrositis to but a few treatments. This fact should be kept in mind when evaluating methods of treatment for any cervical problems. The response of these patients to simple conservative measures is so prompt that they will upset result evaluation unless they are considered as a separate entity. We feel that our results for this group would probably have been even better if those patients who discontinued treatment without consultation could have been evaluated as well.

We were surprised to find the marked similarity between the group of patients who had been injured and those without history of injury. It must be remembered that in a private hospital the patients in the latter group were responsible for their treatment fees while most of those in the former group were compensation cases. The results obtained strengthen our belief that the one factor common to both groups was tension, and that the injury was often merely the precipitating factor rather than the true cause of the complaint. It is very interesting to note that the results for this series of cervical syndromes were almost identical to the initial results obtained by Martin and Corbin[1] for the conservative treatment of cervical discs. They reported 41 per cent complete relief or marked improvement, 39.3 per cent fair and slight improvement, and 19.7 per cent no change. Results for our non-injury group were 41.9 per cent good improvement, 38.5 per cent moderate improvement, and 19.6 per cent no improvement.

From the standpoint of prognosis, we felt the results were rather disappointing. Apparently one cannot promise a patient with a cervical problem complete relief, although one can hope for considerable improvement. From a compensation standpoint, there frequently remains a permanent disability. However, many of these patients can be kept quite comfortable by an intermittent series of professionally administered physical therapy.

Summary

Eight hundred cases of "cervical syndrome" were broken down into various entities and analyzed according to age, sex, and results of treatment.

Characteristic symptoms and findings and method of treatment were discussed. More than one-half of all patients were between thirty and fifty years of age; of these 60 per cent were women and 40 per cent were men.

Acute fibrositis was found to be a separate and distinct category with over 90 per cent good improvement, and an average treatment time of 7.7 treatments.

Results for all other groups were very similar to each other, with only about 40 per cent good improvement and an average treatment time from four to five weeks.

Only a slight difference was found in the degree of improvement for various durations of complaint before treatment was started.

No significant difference was found in the degree of improvement for various durations of treatment and no optimal treatment time could be determined.

For reprints, write Dr. Krusen, 3500 Colgate, Dallas, Texas.

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Role of Non-Directive Play Therapy as a Technic of Psychotherapy in Cerebral Palsy

Edward J. Lorenze, M.D.
and
Ralph Cancro, M.A.
White Plains, N.Y.

The successful management of the child with cerebral palsy throughout the developmental years has as its goal of "habilitation" the evolution of an adult who has achieved his maximal potentialities both in function and adjustment.

These children are particularly challenging because of the countless multiplicity of problems which they present. In addition to the basic neuromuscular disability arising from the brain pathology, there may be complications such as dislocations of the hips, kyphoscoliosis, and soft tissue contractures with joint deformities. The brain pathology obviously may not be limited to motor activities but may also lead to deafness, aphasia, visual disturbances, perceptive difficulties, and even mental retardation. Also, brain injury does not render these children immune to those diseases and injuries which can occur in the non-brain injured child. These too may be present. Finally, emotional disturbances are frequently present which block the potential development and adjustment of the child.

Factors Involved in Emotional Disturbances

We are all aware that emotional illness has its roots in the psychological and social factors of home environment. The handicapped child may have a profound effect on the family group which will in turn, as a result of its attitudes and resultant behavior, affect the emotional growth of the child. The parental attitude and its resultant behavior toward the handicapped child may stifle both development and maturity. Serious maladjustment in early adult life may be

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Assistant Professor of Clinical Medicine, Cornell University Medical College, New York; Medical Director, The Burke Foundation.
Clinical Psychologist, The Burke Foundation.
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anticipated as has in fact been demonstrated by Glick's study of 200 cerebral palsy adults.[1]

All children have emotional needs that must be adequately met if personality aberrations are to be avoided. Guensberg[2] lists four basic requirements for healthy emotional growth: (a) Need for parental love or affection; (b) the need to belong and to feel a part of a family unit; (c) the need for self-expression and recognition, and (d) the need for ego-identification. Tensions arise when these basic needs are not satisfied, and the child acquires certain mechanisms in order to cope with them. Too frequently the mechanism adopted does not reduce tension adequately, and the incipient stage of mal-adjustive, mal-adaptive behavior results.

The extent to which these needs will be satisfied will largely depend on the parental attitudes toward the child. Two types of basic parental attitudes that are frequently seen and that tend to thwart these basic needs are rejection of the child, and overprotection of the child.

A parent-child relationship that is predominately one of rejecting the child has certain characteristics. The parents see mostly shortcomings in the child; are frequently excessively punitive with the child, and have little interest in, or time for the child.

As a result of parental rejection, the child may develop strong feelings of insecurity and inferiority. These feelings may lead to an excessive need for attention which in turn leads to undesirable attention-getting behavior. The rejected child tends to resent authority, to be recalcitrant, unfriendly, and evaluate himself unrealistically. Fantasy is frequently resorted to in order to reduce the tensions produced by the frustration of his needs.

The parent-child relationship that is predominately overprotective toward the child also has certain identifiable characteristics. The parents tend to have excessive contact with the child. They prolong infantile care by dressing, bathing or feeding him when he is sufficiently advanced physically to be performing these functions without aid. The parents tend to supervise, in excess, his activities, and consequently impede the development of self-reliance.

As a result of over-solicitude on the part of parents, the child becomes exceedingly dependent and unsure of himself. Consequently, fantasy and withdrawal may be acquired as defense mechanisms. When circumstances are such as have been outlined, and we recognize that we have discussed only a few of the causative factors, some type of behavior problem will occur. Improvement may lie in removing the causative factors, or through applying psychotherapy which may lead to a better integrated personality and offset the pathological sequelae of unresolved conflicts, frustrations and insecurity.

Depending upon the particular patient, different psychological approaches may be made. We have been using the technic of non-directive play therapy among others for the past year, and present this technic for consideration as an integral part of the therapeutic armamentarium in cerebral palsy clinics.

Technic and Rationale

Play therapy utilizes the child's play activities as its medium, since it is the child's natural mode of self-expression. In the play therapy room, the situation is structured by the therapist so that the child will feel free to express his inner feelings without fear of reproof or condemnation. The child and the various types of behavior of which he is capable of manifesting are accepted. The therapeutic atmosphere is made as permissive as is realistically possible, so that the child will be able to reveal in his play activity the effects of environmental pressures and tensions.

"The therapist establishes only those limitations that are necessary to anchor the therapy to the world of reality and to make the child aware of his responsibility in the relationship."[3] The limitations also serve to prevent the possible development of guilt feelings by the child when his play has become too destructive or aggressive. The child is not

permitted to be wilfully destructive, or to vent physically his hostilities upon the therapist. Once the limitations have been set by the therapist, they are consistently followed. It is through such consistencies that the child becomes secure in the therapeutic relationship.

The therapist, who reacts with warmth, understanding, consistency and acceptance, creates an atmosphere of security for the child while he is in the playroom. The participation of the therapist is characterized by a sensitive understanding of what the child is feeling and expressing through his play and verbalizations. These expressed attitudes, emotions, or feelings are then reflected back to the child in such a way as to help him gain insight into his behavior.

"Non-directive therapy is based upon the assumption that the individual has within himself, not only the ability to solve his own problems satisfactorily, but. . . (a) growth impulse that makes mature behavior more satisfying than immature behavior."[8]

Throughout the therapeutic contact, the responsibility for change, improvement, or growth always remains with the child. He learns that he is responsible for himself. During the play therapy hour the child has an opportunity for self direction and self realization. Inherent in this approach is a basic respect for the child's integrity, and ability to seek out a more satisfying level of adjustment.

To bring about changes in the child's behavior or personality, the play therapy process must first provide an outlet for the tensions and pressures that have been mounting within him. When the child begins to feel secure in the therapeutic relationship, he will play out many of these tensions and conflicts. This "playing out" process is cathartic, and is an important step in the therapy.

The child will reveal his feelings either directly in his verbalizations, or indirectly in his play. An excerpt from a play therapy session at this point will serve to make this principle more meaningful.

A five-year old boy, whose father is a strict disciplinarian, was playing in the play room. He picked up two rubber mice. One was large and the other quite small.

J.B.: "This big one is the daddy mouse and this one is his little son. The daddy says to the litte son, 'You can't go out and play because you've been bad. In fact you can't go out and play any more even when you grow up as big as me.'"

Therapist: "The daddy mouse won't let the little mouse go out and play because he's done something the daddy feels is bad. In fact he won't let him out any more because of what he's done."

J.B.: "That's right. But the little son sneaks out the back and runs away to his friend's house so the daddy can't get him." Child has little mouse run out of the house and then into a box.

Therapist: "The little mouse runs away so the daddy can't get him."

J.B.: "When the daddy finds out his little son ran away he's going to be very sorry."

Therapist: "The daddy is going to be sorry for the way he treated his little son when he finds out he ran away."

J.B.: "Yes. Then the daddy finds out the son is missing. He goes out of the house to find him. He looks all over. He goes into his son's friend's house to look for him there. But there is a big bear waiting in the hall to protect the son. He grabs the daddy and kills him." At this point the child became visibly guilty about his actions toward the daddy mouse. He quickly adds: "But the daddy mouse is very sorry for the way he has treated his little son. So the bear kisses the daddy, and he comes back to life. The daddy then promises to change his ways and treat the little son much better. The little son then goes home with the daddy."

Therapist: "The daddy mouse is killed by the bear because he has treated his son so bad. But when the daddy mouse promises to change, the bear brings him back to life. The son only goes home again with the daddy when he knows the daddy will not be bad to him any more."

J.B.: "That's right. Then they go home together. But once they get into the house, the daddy turns to the little son and says: 'I'm never going to change! You are never going out again. I'll teach you to listen!' When the bear hears this he runs over to the little son's house and kills the father and hangs him by his tail forever and forever and forever." No visible guilt is evident this time.

Therapist: "Although the father said he was going to change, he didn't mean it. And when he got home with his little son, he was no different. He's never going to change so the bear came back and killed him and hung him up forever."

The child is actively playing out aggressive feelings. He resents the authority to which he must submit and recognizes that his father will not grant him the freedom he desires.

The session has been cathartic for the child, in that it offered an emotional outlet for these feelings. It has also served to aid the child in understanding his feelings, although the therapist has been careful not to personalize the child's play. The child spoke of a daddy mouse, so did the therapist. Had the child been ready to verbalize the obvious self reference of the situation he would have done so. Had the therapist personalized the play by a remark such as: "Your daddy is very strict with you," or "Your daddy won't let you out when you've done something he doesn't like," the

child might have retreated from this dynamic expression of aggressiveness to one of less personal threat.

Positive feelings of adequacy, self-confidence, and self-reliance are built up through the relationship established with the child by the therapist. This relationship is founded on mutual trust and confidence. The child is respected for what he is, and is allowed to be self-directing.

If lasting changes are to be effected, the child must devolp insight which is gained from the therapist's reflections and clarifications of the child's feelings. Play therapy is a l e a r n i n g process through which the child comes to understand his feelings, attitudes and reactions.

Analysis of Results

We have had 15 children on play therapy during the past year. Frequency of treatment has been one or two hours weekly with total sessions per patient ranging from 15 to 32 in the group of 10 cases whose results are reported; 5 cases are not reported since they have had too few sessions to date.

Physical Status

The group consists of 7 males and 3 females ranging from 4 to 12 years of age. Diagnoses were 2 left hemi-athetoids, 1 right hemi-athetoid, 1 generalized athetoid, 2 recovered ataxia, 2 left spastic hemiparesis, and 2 mild spastics. All patients had independent ambulation and any deficiencies of upper extremity activity were not felt to be due to neuromuscular involvement. From the basic physical findings, the cases would be classified as mild, and consequently be given a good prognosis as to a satisfactory life adjustment.

Intelligence and School Status

Our estimates of intelligence have been determined on the basis of testing where possible, and on clinical impressions. When measurements were lower than clinical impression, we used our clinical impression since it is well-known that both physical and emotional factors will interfere with successful testing. On this basis, we classified one case bright normal, 2 cases normal, 4 cases dull normal, 3 cases mentally retarded. Of the 3 mentally retarded, one (Case #1) is in a mentally retarded class in public school, one (Case #5) was expelled from regular class in public school, and one (Case #8) has not started attending school.

Of the 7 in the normal range, 3 (Case #6, #9, and #10) are in regular classes, 2 (Case #2, and #7) are still too young, one (Case #4) was dropped from regular class, one (Case #3) is not in school because of lack of speech due to aphasia and emotional immaturity.

Reason for Referral and Results of Play Therapy

These children were referred because of behavior problems of at least one year in duration at home, clinic, or school. The problems were manifested by temper tantrums, attempts at physically harming other children, uncontrolled hyperkinetic activity, lack of attention and cooperation with teachers, parents and therapists, and withdrawal with poor socialization patterns. The other associated cause was absent or retarded speech which was considered, at least partially, due to emotional maladjustment or immaturity.

Speech Problems

Case #1 lacked spontaneous speech and exhibited withdrawn behavior. After 18 sessions, over a period of 3 months, there was significant improvement with a marked increase in spontaneous speech reported by the speech therapist.

Case #2 was unable to speak, was withdrawn and did not socialize with other children and was over-dependent on his mother. After 32 sessions, over a period of 3 months, there was significant improvement with spontaneous speech on the phrase level reported by the family and the speech therapist. The child is less dependent on the mother and is developing constructive play patterns with toys and other children.

Case #3 was also unable to speak, was withdrawn and did not socialize with other children. He was over-de-

Table 1

Case	Reason for referral	Changes in behavior	# Hourly Contacts	Time between onset of therapy and behavior change
1	Withdrawn, lack of speech	Greater spontaneous speech	18	3 months
2	Over dependent on mother; no speech at all	Developing constructive play patterns with toys and other children; spontaneous speech on phrase level	32	3 months
3	Withdrawn, no speech	Less withdrawn; greater spontaneous speech; socializing with other children	20	3 months
4	Very dependent on mother; over aggressive, bad contact with reality, dropped from reg. school	Less disorganized. More independent; testing reality; playing cooperatively with other children	31	5 months
5	Hyperkinetic; over aggressive; expelled from regular school	No significant changes	16	No significant change
6	Problem in regular class, considered for transfer to class for mentally retarded; over aggressive.	Less aggressive and hostile behavior; continued in regular class	15	2 months
7	Over aggressive; refused to cooperate with OT and PT	No significant changes. Dropped from active Rx. To be continued as still hopeful	18	No significant change yet
8	Refusal to cooperate with therapists; withdrawn	Much less withdrawn, more independent behavior; socializing with other children, better cooperation with clinic therapists	17	2 months
9	Withdrawn	Much less withdrawn, more outgoing, friendly and warm	23	4 months
10	Temper tantrums at home	No temper tantrums over 5 month period	16	3 months

Table 2

Case	Sex	Age	Diagnosis	Intelligence	Siblings
1	F	8 yrs., 7 mos.	Spasticity, mild	Mentally retarded	Male — 22 yrs. Female — 20 yrs. Female — 18 yrs. Female — 11 yrs.
2	M	3 yrs., 11 mos.	Recovered ataxia	Normal	Female — 6 yrs.
3	M	6 yrs., 4 mos.	Recovered ataxia, aphasia	Dull normal	Female — 11 yrs. Male — 13 yrs. Female — 22 yrs. Male — 25 yrs.
4	M	8 yrs., 0 mos.	Spasticity, mild	Dull normal, borderline psychotic	None
5	M	9 yrs., 10 mos.	Left hemiathetosis	Mentally retarded	None
6	F	10 yrs., 9 mos.	Left hemiathetosis	Dull normal	Male — 13 yrs.
7	M	4 yrs., 6 mos.	Right hemiathetosis	Dull normal	Male — 1 yr.
8	M	5 yrs., 8 mos.	Left spastic hemiparesis	Mentally retarded	None
9	F	10 yrs., 9 mos.	Left spastic hemiparesis	Normal	Male — 5 yrs.
10	M	12 yrs., 10 mos.	Athetosis, mild	Bright Normal	Female — 7 yrs. Male — 3 yrs. Female — 10 yrs.

pendent on his mother. After 20 sessions, covering a period of 3 months, there was significant improvement with the development of spontaneous speech. The child is less withdrawn and is socializing with others.

Over-Aggressive Behavior Leading to School Problems

Case #4 manifested an over-aggressive behavior pattern leading to discharge from regular class. This child was considered of dull normal intelligence and a border-line psychotic. He was very dependent on his mother and established very poor contact with reality. After 31 sessions, over a period of 5 months, the child made significant improvement. He is less dependent on his mother, less disorganized, and is now testing reality. He is less aggressive and plays cooperatively with other children. Although discharged from the regular class he was admitted to a mentally retarded class where he is adjusting well.

Case #5 manifested an over-aggressive behavior pattern which led to discharge from regular class. This child was considered mentally retarded with severe hyperkinetic activity. After 16 sessions, during a period of 5 months, no significant change in behavior was noted.

Case #6 exhibited an over-aggressive behavior pattern and was being considered for transfer to a class for the mentally retarded, although she was considered dull normal. After 15 sessions, lasting 2 months, there was significant improvement. The child's behavior became less aggressive which resulted in her continuation in regular school.

Lack of Cooperation with Therapists

Case #7 displayed an over-aggressive behavior pattern with refusal to cooperate with the physical and occupational therapists. This child was considered of dull normal intelligence. After 18 sessions, during 3 months, no significant change in behavior was noted. The child had been dropped from active physical and occupational therapy but will be continued on play therapy since it is felt there is still hope for improvement.

Case #8 manifested a withdrawn behavior pattern with refusal to cooperate with the therapists in the clinic. This child was considered mentally retarded. After 17 sessions, lasting 2 months, it was noted that the child was less withdrawn, more independent, and was socializing with other children. There was improved cooperation with the therapists.

Severe Withdrawal

Case #9 manifested a withdrawn, dependent behavior pattern characterized by passive resistance and unconcern. After 23 sessions, during a period of 4 months, it was noted that the child had become much less withdrawn and was more outgoing, warm and friendly.

Temper Tantrums

Case #10 manifested temper tantrums at home. These were of such frequency and severity that normal family life was disrupted. This child was considered of bright normal intelligence. After 16 sessions, lasting 3 months, the child showed no further temper tantrums.

Summary of Results

Ten children considered to have psychological problems resulting in specific behavior problems or speech retardation were placed on a program of play therapy. On follow-up evaluation of these patients in terms of the original reasons for referral, there was definite improvement in behavior or speech in 8 children and no change in 2 children. It is observed that these children lived with both parents under satisfactory socio-economic circumstances. Sibling combinations which ranged from 0 to 4 with varying age and sex distribution, did not appear to be significant factors. While no control study is reported at this time, and it is difficult to rule out the effect of time, growth, and other changes in the child's environment as factors, it is our clinical impression that

the children with emotional disturbances, who have been on play therapy, have made greater improvement in behavior, speech and cooperation with therapists, than similar cases who have not had the benefit of psychotherapy.

Conclusion

Parental attitudes may thwart the basic requirements for emotional growth in the child and thereby lead to emotional maladjustment.

In addition to the physical disability, we have attempted to indicate that emotional maladjustment occurs in cerebral palsy children.

Behavior problems which may make education, and treatment difficult or impossible arise.

Speech and functional activities which are physically and intellectually within the child's capacities may be retarded.

In our experience, emotional problems are found with sufficient frequency in cerebral palsy children to warrant the inclusion of psychological services as an integral part of the therapeutic programs in cerebral palsy clinics.

Psychological testing and even evaluation are not enough, as actual therapy, guidance and parental counseling should also be provided.

At the Burke Foundation Cerebral Palsy Clinic, non-directive play therapy has been found to be a practical and useful technic for the management of emotionally disturbed children.

For reprints, write Dr. Lorenze, Medical Director, The Burke Foundation, White Plains, N.Y.

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Report of the Finance Committee

The report of our auditor which follows indicates that for the year ending December 31, 1954, the American Congress of Physical Medicine and Rehabilitation continued to operate on a sound financial basis.

Louis B. Newman
Charles S. Wise
Harry T. Zankel

AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

Report on Examination For the Year Ended December 31, 1954

May 1, 1955

Board of Governors,
American Congress of Physical Medicine
and Rehabilitation,
30 North Michigan Avenue,
Chicago, Illinois

Dear Sirs:

I have examined the balance sheet of the American Congress of Physical Medicine and Rehabilitation as of December 31, 1954, and the related summary of net income and surplus for the year then ended. My examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as I considered necessary in the circumstances, except as stated in the following paragraph.

I did not verify the income from subscriptions to ARCHIVES, a magazine published monthly by the Congress, because it was not considered practicable. However, I tested the correctness of the subscription income recorded on the books by reference to available supporting data.

Based on my examination, limited to exclude verification of ARCHIVES subscription income, in my opinion, the accompanying balance sheet and summary of net income and surplus present fairly the financial position of the American Congress of Physical Medicine and Rehabilitation at December 31, 1954, and the results of its operations for the year then ended in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

I submit the following exhibits:

Exhibit
A—Balance Sheet, December 31, 1954
B—Summary of Net Income and Surplus for the Year Ended December 31, 1954.

Yours truly,
Joseph Kanovski
Certified Public Accountant

Exhibit A

American Congress of Physical Medicine
and Rehabilitation
(Incorporated in Illinois — Not for Profit)

Balance Sheet, December 31, 1954

Assets

Current Assets:		
Cash:		
Michigan Avenue National Bank of Chicago	$13,562.46	
Bell Savings and Loan Association	10,000.00	
Petty Cash	100.00	$23,662.46
Accounts receivable:		
Advertisers and exhibitors	$ 1,494.71	
Membership dues	100.00	
American Registry of Physical Therapists	10,206.38	
American Board of Physical Medicine and Rehabilitation	197.75	
American Society of Physical Medicine and Rehabilitation	141.99	12,140.83
Investments in United States Savings bonds — at cost		38,000.00
Accrued interest		300.01
Deposit at United States Post Office		50.00
Total		$74,153.30

Liabilities

Current Liabilities:		
Accounts payable		$ 1,047.77
Accrued payroll taxes		285.02
Dr. John S. Coulter Memorial Fund		750.00
Subscriptions to ARCHIVES —unexpired portion		7,772.14
Dues collected in advance — year 1955		262.00
Total current liabilities		$10,116.93
Surplus, per Exhibit B		64,036.37
Total		$74,153.30

Exhibit B

American Congress of Physical Medicine and Rehabilitation
Summary of Net Income and Surplus
For the Year Ended December 31, 1954

Income:		
Membership dues		$11,280.00
ARCHIVES:		
Advertising—less discounts — net	$13,464.66	
Subscriptions	14,237.91	
Sale of cuts, etc.	1,216.67	28,919.24
Interest on United States Savings Bonds		952.14
Convention income:		
Exhibits	$11,250.00	
Special instruction course	1,278.95	
Total	$12,528.95	
Direct convention expenses	6,209.41	
Convention income —net		6,319.54
Miscellaneous		163.51
Total income		$47,634.43
Expenses:		
Office salaries and expenses:	$26,640.37	
Printing—ARCHIVES	16,371.08	
Cuts, half-tones, electros, etc.	1,029.63	
Pay roll taxes	275.59	
Professional fees	920.00	
Public relations	62.01	
International Federation of Physical Medicine	150.36	
Special meeting	432.95	
Educational conference	284.71	
Richard Kovács Memorial Fund	200.00	
Sundry	819.39	
Total expenses	$47,186.09	
Less share of expenses billed to:		
American Board of Physical Medicine and Rehabilitation	$ 250.00	
American Society of Physical Medicine and Rehabilitation	250.00	
American Registry of Physical Therapists	14,000.00	
Total	$14,500.00	
Expenses — net		32,686.09
Net income for the year		$14,948.34
Surplus at beginning of the year	$49,995.78	
Adjustment for expenses applicable to the prior year	907.75	49,088.03
Surplus at end of the year		$64,036.37

AMERICAN SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

Report on Examination

For the Year Ended December 31, 1954

May 1, 1955

Board of Governors,
American Society of Physical Medicine and Rehabilitation,
30 North Michigan Avenue,
Chicago, Illinois

Dear Sirs:

I have examined the balance sheet of the American Society of Physical Medicine and Rehabilitation as of December 31, 1954, and the related statement of net income and surplus for the year then ended. My examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as I considered necessary in the circumstances.

In my opinion, the accompanying balance sheet and statement of net income and surplus present fairly the financial position of the American Society of Physical Medicine and Rehabilitation at December 31, 1954, and the results of its operations for the year then ended in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

I submit the following exhibits:

Exhibit
A—Balance Sheet, December 31, 1954.
B—Statement of Net Income and Surplus for the Year Ended December 31, 1954.

Yours truly,

Joseph Kanovski
Certified Public Accountant

American Society of Physical Medicine and Rehabilitation
(Incorporated in Illinois — Not for Profit)

Balance Sheet, December 31, 1954

Assets

Current Assets:		
Cash:		
Michigan Avenue National Bank of Chicago		$ 1,479.66
Bell Savings and Loan Association		2,000.00
Investment in United States Savings bonds —at cost		500.00
Accounts receivable—members		30.00
Total		$ 4,009.66

Liabilities

Current Liabilities:		
Accounts payable:		
Trade		$ 150.00
American Congress of Physical Medicine and Rehabilitation		141.99
Dues and special assessment collected in advance		210.00
Total current liabilities		$ 501.99
Richard Kovács Memorial Fund	$ 250.00	
Cash—Bell Savings and Loan Association	250.00	
Surplus, per Exhibit B		3,507.67
Total		$ 4,009.66

Exhibit B

American Society of Physical Medicine and Rehabilitation

Statement of Net Income and Surplus
For the Year Ended December 31, 1954

Income:		
Members' dues		$ 795.00
Initiation fees		420.00
Banquet—annual meeting —net		55.40
Miscellaneous		71.50
Total income		$ 1,341.90
Expenses:		
Share of office expenses billed by American Congress of Physical Medicine and Rehabilitation	$ 250.00	
Professional fees	337.22	
Office supplies	80.31	
Miscellaneous	106.11	
Total expense		773.64
Net income for the year		$ 568.26
Surplus at beginning of the year		$ 3,131.69
Adjustment for expenses applicable to the prior year	192.28	2,939.41
Surplus at end of the year		$ 3,507.67

AMERICAN REGISTRY OF PHYSICAL THERAPISTS

Annual Report

January 1 — December 31, 1954

The major activities of the Registry follow the purposes for which it was organized; namely, to promote the art and science of medicine through an understanding and utilization of the functions and procedures of physical therapy in the prevention, treatment or alleviation of human ailments and the maintenance of or restoration to health; to maintain a list of physical therapists competent and qualified to administer adequately physical therapy under the prescription, direction and supervision of licensed physicians, and to promote a widespread utilization of such list to the end that the facilities and methods employed in physical therapy may effectively augment the services of American medicine. All of its activities represent an effort on the part of the Registry to carry out its original purposes. No phase of service is overlooked in this effort.

Dr. Arthur L. Watkins was appointed to serve on the Board for a period of seven years beginning January 1, 1954. Dr. Wm. Benham Snow was appointed to serve on the Board for a period of seven years beginning January 1, 1954. He was selected to replace Dr. George Morris Piersol.

At the Interim Meeting, April 24, 1954, Hotel Statler, New York City, the following motions were passed:

The following therapists now in the junior classification be granted senior registration without examination: Sr. Mary Kostka Glueckstein, John V. R. Logan, Myra Miller, and Ermenia Pignatelli.

The following therapist is to retain her junior classification: Emma Hupprich.

Registry to go on record that it is in accord with decision of AMA Council on Medical Education and Hospitals relative to formal training and recognition of new group of therapists outside VA to do conditioning and so-called rehabilitation technics.

Committee to be appointed to determine best method or procedure for investigating therapists, lifting certificates, and right of appeal by therapists.

Present certificate and wallet-size membership card to be retained.

Students with foreign background may use standard bi-lingual (not medical) dictionary at time of Registry examination; all physical therapy schools are to be so informed.

Confirmation of appointment of Dr. Douglas Buchanan to serve on Advisory Board as representative of the American Neurological Association.

At the Annual Meeting, September 8, 1954, Hotel Statler, Washington, D.C., the following motions were passed:

Appropriation of $2,000 for committee to study state registration laws.

Review and/or revision of Constitution and By-Laws as well as Principles of Ethics.

Election of Dr. Earl C. Elkins, Chairman of the Board; Dr. Robert L. Bennett, Vice-Chairman, and Dorothea C. Augustin, Registrar-Secretary-Treasurer.

A number of special problems were considered and several interim actions were completed by the Registry Board in 1954.

The following registrations were cancelled: Mrs. Louise R. Cowperthwaite, 2525 Maple St., Apt. 23, Dallas, Texas; Mrs. Ruth L. Cralle, RFD 1, Box 30, Rice, Va.; Mr. William V. Reilly, 97 Perry St., New York, N.Y.; Mr. Harry Royson, 162 W. 54th St., Apt. 2C, New York, N.Y., and Miss Gloria M. Stewart, Director of Physical Therapy, St. Mary's Hospital, 2500 Sixth St. South, Minneapolis, Minn.

The following members were reinstated: Mrs. Betty Dingacci, 375 W. Williams Ave., Fallon, Nevada; Mrs. Ruth Holman, P. T. Dept., Rancho Los Amigos, Hondo, Calif.; Mrs. Lois O'Connell, 374 Murchison Lane, Dayton, Ohio; Miss Esther Rosso, 2535½ Elsinore, Los Angeles, Calif., and Miss Carolyn Russell, 40 Waumbeck St., Roxbury, Mass.

The following members have been dropped from the roster of therapists in good standing for non-payment of dues: Lemel D. Aldubi, Myrta E. Annoni, Esperanza Ares, Audrey Ashworth, Helen Atkins, Toinette Balkema, Barbara M. Barry, James M. Bauer, Ida M. Boice, Evelyn S. Bouden, Frederick Briccetti, Eleanor Brothwell, Joyce A. Cairns, Margaret da Cunha, Dorothy M. Dean, Maryvonne de Kinsky, Lelia Dickson, Helen M. Dobbin, Alice V. Donohue, Florence Doran, Barbara Draper, Alice F. Droney, Mildred Duffy, Frances Falkenstine, Esther Feldsher, Nancy Lee Fix, John M. Gabala, Maxine Gibson, Imogene Grant, Robert Hartmann, Muriel Hoff, Bessie W. Hooper, Donald Hurry, Mary W. Johnson, Chessie Kouba, Mary Anne Krieger, Helen Kusch, Anne Lawlor, Selvin Lewis, Jean R. Magee, Theodore Marton, Bessie T. May, William L. McAndrew, Jane C. McDowell, Violet J. McInnis, Angeline P. Miles, John H. Monlux, Marjorie Montague, Esther S. Myers, Cecile H. Pate, Kenneth Pedrone, Jacquelin Perry, Phyllis Petrosky, Viola K. Plocar, Ardes Porter, Edwin W. Powell, Jr., Ariel Powers, Rita Pyfferoen, Cecil L. Ramsel, Ida Reymond, George Rickert, Eunice Riley, Patricia Rooney, William Santee, Helen Sitterley, Laura K. Smith, Hazel P. Snyder, Iris Sotomayor, John L. Stevens, Henry Thompson, John J. Untereker, Virginia Valdivia, Paula Wildanger, Marjorie Williamson, Dorothy D. Wilson, and Marie C. Zeiler.

The following members have dropped their membership: Frances M. Andersen, Gertrude Beard, Lillie M. Beckman, Carolyn M. Brown, Jack D. Brown, Mae J. Buckner, Alice B. Clay, Margaret I. Cochrane, Alice Lou Converse, Mary Ann Erickson, Margaret M. Farley, Elizabeth Fountaine, Anna Marie Fronapfel, Elizabeth A. Garrett, Ruth Golson, Cleo Jeanne Hansson, Betty May Hartmann, Elvira Hoffmire, Rebecca Sue Holton, Valerie Hunt, Rachel Jennings, Betty Kastendike, Louise W. Keegan, Florence Kendall, Henry Kendall, Maria M. Kennedy, Margaret Kenrick, Sheila Kiefer, Helen King, Lillian E. Kron, Sr. Ladislava Laskowski, Evelyn May, Mabel McCraw, Hazel McNatt, Irene Mezek, Dorothy Morse, Gladdes Neff, J. Wesley Osborne, Betty Perkins, Harriet Peterson, Harold Pfluger, Edward Rathjen, Susan G. Roen, Alice Seligman, Bernadette Taylor, Emma E. Vogel, Regina Whitehead, Peggy Wolfe, and Jean A. Zimmerman.

The following members are deceased: Coralynn A. Davis, Louise H. Henry, Margaret A. Hockenberger, Lucy S. Kaiser, Charles L. Morris, and Birdean Richmond.

Certificates Issued According to School of Graduation

Name of School	Number of Graduates Registered
Albany Hospital, Albany, N.Y.	8
Boston University College of Physical Education for Women, Sargent College, Cambridge, Mass.	40
Bouve-Boston School of Physical Education, Medford, Mass.	12
University of Buffalo, Buffalo, N.Y.	17
University of California, School of Medicine, San Francisco	15
Charity Hospital of Louisiana, New Orleans	8
Childrens Hospital, Los Angeles	12
Cleveland Clinic, Bunts Educational Institute, Cleveland	15
College of Medical Evangelists, Los Angeles	8
University of Colorado, Denver	10

Columbia University, College of Physicians and Surgeons, New York City	28
University of Connecticut, Storrs	18
Duke University, Durham, N.C.	12
Hermann Hospital, Houston, Texas	12
State University of Iowa College of Medicine, Iowa City	14
University of Kansas Medical Center, Kansas City, Kans.	12
Mayo Clinic, Rochester, Minn.	26
Medical College of Virginia, Richmond	41
University of Michigan, Ann Arbor	13
University of Minnesota, Medical School, Minneapolis	12
New York University, School of Education, New York City	5
Northwestern University Medical School, Chicago	20
Division of Physical Therapy, School of Auxiliary Medical Services, University of Pennsylvania, Philadelphia	39
St. Louis University, St. Louis	10
Simmons College, Boston	9
University of Southern California, Los Angeles	25
Stanford University, Stanford University, Calif.	33
University of Texas School of Medicine, Galveston	6
Washington University School of Medicine, St. Louis	9
D. T. Watson School of Physiatrics, Leetsdale, Pa.	24
University of Wisconsin Medical School, Madison	27
Medical Department—U. S. Army	
Brooke Army Medical Center, Ft. Sam Houston, Texas	17
Letterman Army Hospital, San Francisco	13
Walter Reed Army Hospital, Washington, D.C.	7
TOTAL	577
Number of registrations completed	577
Number of examinations conducted	551
Number of retake examinations conducted	23

The report of the auditor which follows indicates that for the year ending December 31, 1954, the American Registry of Physical Therapists continued to operate on a sound financial basis.

AMERICAN REGISTRY OF PHYSICAL THERAPISTS

Report on Examination For the Year Ended December 31, 1954

May 1, 1955

Board of Registry,
American Registry of Physical Therapists,
30 North Michigan Avenue,
Chicago, Illinois

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Yours truly,

Joseph Kanovski
Certified Public Accountant

Exhibit A

American Registry of Physical Therapists
(Incorporated in Illinois — Not for Profit)

Balance Sheet, December 31, 1954

Assets

Current Assets:		
Cash:		
Michigan Avenue National Bank of Chicago	$29,202.48	
Bell Savings and Loan Association	2,500.00	$31,702.48
Accounts receivable — dues and registration	$ 1,101.00	
Less reserve for possible losses	505.00	596.00
United States Savings bonds —at cost		40,000.00
Accrued interest		363.97
Total		$72.662.45

Liabilities

Current Liabilities:		
Accounts payable:		
Trade	$ 1,295.65	
American Congress of Physical Medicine and Rehabilitation	10,206.38	$11,502.03

Accrued federal excise tax	54.45
Dues collected in advance —year 1955	14,228.00
Deposits with applications (subject to refund if applications are rejected)	885.00
Total current liabilities	$26,669.48
Surplus, per Exhibit B	45,992.97
Total	$72,662.45

Exhibit B

American Registry of Physical Therapists

Statement of Net Income and Surplus
for the Year Ended December 31, 1954

Income:		
Dues		$17,708.50
Registration fees		9,577.00
Sales:		
Pins	$ 909.00	
Emblems	469.95	
Directory	287.75	1,666.70
Interest on United States Savings bonds		992.80
Miscellaneous		11.93
Total income		$29,956.93
Expenses:		
Share of office expense billed by American Congress of Physical Medicine and Rehabilitation	$14,000.00	
Printing and multigraphing	380.52	
Examinations — supervision and grading	612.00	
Board meeting	603.57	
Purchase of pins	505.00	
Office supplies	516.62	
Special conferences	1,653.20	
Office equipment	669.68	
Fidelity bond premium	16.87	
Professional fees	696.00	
Provision for losses on uncollectible dues	298.00	
Purchase of emblems	401.70	
Directory	2,251.03	
Survey of Physical Therapy Schools	1,000.00	
Legislative Committee	279.84	
Miscellaneous	66.83	
Total expenses		23,950.86
Net income for the year		$ 6,006.07
Surplus at beginning of the year	$40,451.37	
Adjustment for expenses applicable to the prior year	464.47	39,986.90
Surplus at end of the year		$45,992.97

Respectfully submitted,

AMERICAN REGISTRY OF PHYSICAL THERAPISTS
Dorothea C. Augustin, Registrar

AMERICAN SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

Officers and Committees

1955

President — Harold Dinken
President-Elect — Ben L. Boynton
Vice-President — Murray B. Ferderber
Secretary-Treasurer — Max K. Newman

Board of Governors

Ben L. Boynton
Nila Kirkpatrick Covalt
Harold Dinken
Murray B. Ferderber
Louis B. Newman
Max K. Newman
Herman L. Rudolph
George D. Wilson

Membership

Fritz Friedland, Chairman
Hans J. Behrend
Robert W. Boyle

Nominating

Ray Piaskoski, Chairman
Morton Hoberman
Arthur C. Jones

Program

Louis B. Newman, Chairman
Edward M. Krusen, Jr.
Ralph E. Worden

By-Laws

Earl C. Elkins, Chairman
Ben L. Boynton
Miland E. Knapp
Frederic J. Kottke
Donald L. Rose

Liaison with Association of American Medical Colleges

Donald A. Covalt, Chairman
Robert L. Bennett
Arthur L. Watkins

Liaison with American Hospital Association

William Bierman, Chairman
H. Worley Kendell
Donald J. Erickson

Survey of Economic Status of Physiatrists

Frances Baker, Chairman
O. Leonard Huddleston
Arthur C. Jones

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation and/or the American Society of Physical Medicine and Rehabilitation.

LEAVES FROM A DOCTOR'S DIARY. By *Edith E. Johnson*, M.D. Cloth. Price, $3.50. Pp. 279. Pacific Books, Publishers, Box 558, Palo Alto, Calif., 1954.

Dr. Johnson details her everyday experiences as a woman doctor in a small town. The book is written in diary fashion, dating from 1932 through 1952. In the opinion of the reviewer, its contents are of interest only to the author, her family and acquaintances and, of course, her patients.

RECENT PROGRESS IN HORMONE RESEARCH. The Proceedings of the Laurentian Hormone Conference. Edited by *Gregory Pincus*. Vol. X. Cloth. Price, $9.80. Pp. 511, with illustrations. Academic Press Inc., 125 E. 23rd St., New York 10, 1954.

Transactions of the tenth such conference on hormones which took place at Mont Tremblant, Quebec, in September 1953 are covered in this book. These conferences gather together representatives of most of the larger pharmaceutical manufacturers of the United States and Canada. Guests at this conference included representatives from Great Britain, Israel, and Sweden. Representatives from various universities and research laboratories from the fields of anatomy, experimental biology, pharmacology, biochemistry, radiology, gynecology, endocrinology and medical research, presented papers which receive liberal discussion throughout the pages of the book.

The primary problems for discussion were Nervous System—Hormone interrelationships; Thyroid Hormone Physiology and Biochemistry; Comparative Endocrinology; Protein Hormones; The Role of Hormones in Blood and Blood-Forming Organs, and Aspects of Clinical Endocrinology.

The volume is replete with endocrine and metabolic references and has an excellent index covering the contents. The volume on semigloss paper throughout allows fine detail of many graphs and slide reproduction with which the book abounds.

DIAGNOSIS OF SOFT TISSUE LESIONS. By *James Cyriax*, M.D. Cloth. Price, $12.50. Pp. 692, with illustrations. Paul B. Hoeber, Inc., 49 E. 33rd St., New York 16, 1954.

This challenging book and subject title is bound to be controversial and much discussed by its readers. The full title is suggestive of the author's concept and opinions regarding many of the clinical conditions frequently encountered and treated by the physiatrist. The title attempts to convey the author's opinion that a new medical specialty is needed to care for the large mass of patients whose commonest complaint is pain affecting a moving part of the body. He is confronted with the fact that such complaints and conditions seldom call for treatment by surgical means, are often treated by physical means, and are, in his opinion, best described as medical orthopedic conditions requiring manipulation, massage, traction, and therapeutic exercise in their management. The author goes out of his way to point out that practitioners of physical medicine have shown little interest in such therapeutic procedures and are likewise developing special diagnostic technics of their own in the field of electrodiagnosis. According to the author, the orthopedic physician of the future should team his efforts with the orthopedic surgeon and would deal with soft tissue lesions such as sprains, strains, subluxations, and traumatic conditions of a nonsurgical nature. The author feels that such an alignment would dissociate the patient's treatment needs from the available apparatus and technics to be found in the average physical therapy clinic and thus would be logical and specific rather than based upon the apparatus or technics of the personnel available in the clinic caring for the patient.

The book is divided into twenty-five chapters, the first six of which deal in generalities and reflect the author's opinion on several controversial subjects such as medical terminology, the etiology of traumatic inflammation and the mechanism of referred pain. The book then becomes more detailed and specific, taking up in order the several anatomical regions from a musculoskeletal standpoint, be-

ginning with the head and neck and ending with the foot. Lesions of the shoulder joint are discussed in detail; manipulative procedures are described for the management of certain selected pain conditions in the chest. Lesions of the low back and pelvic girdle are discussed in much detail as to signs, symptoms, and treatment. The author belongs to that school of physicians who attribute "over 90 per cent" of symptoms referable to the low back as being due to lumbar disc lesions. He feels that evolutional changes in the matter of the erect posture contribute little to the patient's condition or its relief and he feels that back exercises including flexion exercises in the treatment of disc lesions are foolish. The book is completed with three chapters covering the role of anesthesia and analgesia, psychogenic pain, and the relationship of the physician to his "physiotherapist." The author feels that the physiotherapist must be regarded as an expert assistant rather than an underling since he is skilled in the application of special treatment technics. The use of bibliography and references leaves much to be desired in that most references are of a nonspecific nature and are difficult to trace. The minute detail with which lesions and treatment technics are described makes the book interesting reading for anyone concerned with the problem of soft tissue disease and injury resulting in painful motion.

The author ably piques the reader's interest with the categorical style he employs in describing and dealing with this controversial subject. More liberal use of bibliography and references would improve the value of the book as a teaching text, presenting in resume' form what is now employed in the diagnosis and treatment of soft tissue lesions. The book thus adds very little that is new to either diagnosis or treatment of these conditions, but has definite speculative and stimulative value.

SYMPOSIUM ON FATIGUE. Edited by *W. F. Floyd* and *A. T. Welford*. Cloth. Price, $4.00. Pp. 196, with illustrations. John de Graff, Inc., 64 W. 23rd St., New York 10, 1954.

This book contains twenty of the papers presented at the Symposium on Fatigue held at the College of Aeronautics, Cremfield, England in 1952 under the auspices of the Ergonomics Research Society. The papers include carefully documented work on the environmental factors which alter the onset and amount of fatigue, as well as intrinsic factors within the individual responsible for fatigue. Psychological and physiological considerations are included and the difficult problem of objective measurements of fatigue is discussed comprehensively. As a reference text, it is not satisfactory because there is only a table of contents listing titles of papers. However, information is included which is valuable to anyone working with normal subjects or with patients with weakened musculature, where fatigue factors must be considered in training. Conditions ordinarily increasing fatigue may be altered to postpone the onset or prevent it and, therefore, these papers have a socio-economic value, as well as an interest for purely physical reasons.

BASIC ANATOMY. By *G. A. G. Mitchell*, O.B.E., T.D., M.B., and *E. L. Patterson*, M.D. Cloth. Price, $10.00. Pp. 438, with 286 illustrations. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, 1954.

This intriguing volume reminded the reader of some of his earlier college courses and experiences with their tantalizing efforts to make knowledge palatable even though pointless. The anticipated role of the text in scientific education is best put in the words of the authors who state, "We have several aims in view but the chief of these are (a) to present basic information about human anatomy and synthesize facts from various subjects into a *story* that may serve as a bridge between biology, anatomy, physiology, and clinical subjects; (b) to attempt to explain briefly how man has evolved and developed, how his various cells and tissues are arranged, and how a knowledge of structure explains many ordinary phenomena of life, and (c) to provide an epitome of the main facts about the various bodily systems." Such a broad, general scope for a book is bound to result in general and nonspecific information which can have no place in the technical education of graduate students or medical personnel. A significant departure is the method of handling the subject matter by a review of systems rather than in the usual manner of discussing anatomical information by body regions. This fact is probably the greatest single weakness in the book as a scientific text.

The book is well written, consists of fourteen chapters amply illustrated with figures and photographs of general, historic and nonspecific nature. A glossary of terms is quite complete and will certainly be of help to the novice reading on the subject for the first time. There is also a subject index which is adequate for the casual reader.

The chapter which covers the nervous system provides the most detailed and specific information to be found in the text and is especially well written. Here the embryology and organization of the nervous system are reviewed, following which the parts of the nervous system are described in terms of their functional components. The autonomic nervous system is briefly covered in terms of its subdivisions as well as the outflow and inflow systems at various levels of the brain and spinal cord.

This text can have little value in terms of specific knowledge requirements for the student in the clinical or graduate field of medicine or the basic sciences. It no doubt admirably fills the role outlined by the authors as a "bridging medium" and serves as a compendium of general facts and knowledge for the casual or uninformed reader in the field of human anatomy.

AN OUTLINE OF PSYCHIATRY. By *Clarence J. Rowe*, M.D. Paper. Price, $1.75. Pp. 62. Wm. C. Brown Company, 915 Main St., Dubuque, Iowa, 1954.

One's curiosity is excited in the very introduction to the book by the author's statement that this outline was written for a course which he taught to students of *nursing, occupational therapy, physical therapy* and some of the other *ancillary medical sciences.* Is this the long awaited book on psychiatry designed for those working in the field of physical medicine and rehabilitation?

The author himself promptly limits the scope of his book by renouncing any claim that it may take the place of a textbook on the subject. In the first three chapters entitled "Etiology and the Nature of Symptoms," "Anxiety," and "Defenses Against Anxiety" (mental mechanisms) are introduced the basic principles of psychiatry. The following chapters deal with the various mental disorders including a discussion of psychosomatic conditions. The last chapter is devoted to "Treatment in Psychiatry." This is the chapter where Attitude Therapy, Occupational Therapy, Recreational Therapy, and Hydrotherapy are but very briefly and casually outlined. For instance: "Sedative packs: The patient is wrapped in wet sheets." There is also a short supplementary reading list and an index.

The material is very well organized and clearly presented in a simple, easily readable outline style. The disease entities are not only defined but each is followed by a list of the most common synonyms. In addition to the usual description of origin, etiology, and symptomatology of each condition, the author included a paragraph dealing with the psychodynamics (and psychopathology) of every disorder and even managed to append one or more case histories to each. In spite of a mere sixty-two pages, the book covers the subject rather comprehensively within the limits of its format.

Because of the originality and many good qualities of the book, it is the more regrettable that one finds in it certain archaisms and errors. In spite of the fact that both the author and the publisher (in the announcement leaflet) seem to stress the point that the book's classification of mental illness follows closely the *current* issue of "The Standard Nomenclature of Diseases," such outdated reference to mental conditions as "functional" and "organic" is frequently repeated in the text and in the author's own classification. Involutional Melancholia is still classified in this book among the Affective Reactions. In listing psychosurgical procedures the author gives the impression that frontal *lobectomy* (". . . similar to lobotomy except that the frontal lobes are removed . . .") is a standard method in surgical treatment of the mentally ill. In describing a sedative continuous flow bath ("sedative tub" in the book) the temperature of the water is given as "(about 99°)".

In view of these deficiencies, this book—a potentially well-deserving contribution within the scope of an outline—can be recommended only with some reservations. As to a book on psychiatry specifically designed for students in the field of physical medicine and rehabilitation, such a book is yet to be written—the field is virgin.

ADD LIFE TO YOUR YEARS. By *Ernst P. Boas*, M.D. Cloth. Price, $3.50. Pp. 278. Medill McBride Company, 200 E. 37th St., New York 16; McClelland & Stewart, Ltd., Toronto, 1954.

This book purports to show "how to overcome the physical handicaps which come with advancing age and meet the mental and other readjustments to bring and maintain lasting happiness." While it does discuss many phases of the problem of aging, it hardly achieves the objective quoted from its dust jacket. It is difficult to determine just what groups the author proposed to reach. He states in the preface that it is not "a home medical adviser," yet it probably goes into too much detail in describing the diseases of old age for the average lay reader. In his introduction, the author concludes that "the possibility of achieving a happy maturity in old age is within our grasp. Medical science, which has contributed so much by increasing the average life span of the people of this country, can help them enjoy these added years of life in comfort and usefulness. The physician alone is powerless without the intelligent cooperation of the aging person." This statement is perhaps true but the author, as has every other author dealing with this subject, falls short of providing the solution to many of the problems of the aging.

The book is divided into seventeen sections dealing with such subjects as those first considered, namely, bodily changes which come with age, general guides for healthy living, and symptoms and their interpretation. These introductory sections are followed by discussions of various diseases of old age. These discussions utilize most of the pages of

the book. The text concludes with chapters on euthanasia and on social attitudes toward the aging. The section on diseases of the heart and arteries is extensive, since the author is a cardiologist. Statements in certain other sections are open to question. For example, in discussing "bursitis of the shoulder," the author makes the broad statement that "diathermy treatments are useless and often aggravate the pain." He adds that "the best treatment is with cortisone." This reviewer believes that the great majority of medical experts on the management of various types of bursitis occurring in the region of the shoulder will disagree with these two broad statements. In his chapter on euthanasia, Boas, wisely, supports the moral obligation of every physician "to leave untried nothing which may contribute to the conquest of the illness and the restoration of health."

In the final chapter, on social attitudes, the author goes further than most physicians will go in recommending expansion of existing social security laws. In discussing the law on old age and survivors' insurance, he states that "the provisions of this law should be liberalized" and he mentions a bill introduced in Congress to provide hospital care for recipients of old age and survivors' insurance; then he comments, "If this bill were passed it would be a good beginning, but no more than that."

This book does not fulfill the objective mentioned at the beginning of this review but should perhaps be read by physicians interested in the field of geriatrics. Such physicians will have to decide for themselves whether they think it should be placed in the hands of their geriatric patients.

PLASTIC SHINS FOR ARTIFICIAL LEGS: Investigations with Respect to the Design, Manufacture, Use and Evaluation of Laminated Plastic Shins for Artificial Legs. Submitted by: *Charles C. Asbelle*, Assistant Research Director and *Thomas J. Canty*, Medical Corps, USN, Research Director. Final Technical Report Research Project NM 007 084.10. Paper. Pp. 75, with 47 illustrations. Amputation Center, USN Hospital, Oakland, Calif., 1954.

This report contains the technical findings of a research project concerning an investigation relating to design, manufacture, use, and evaluation of laminated plastic shins for artificial legs. It is an excellently written report, giving the historical background of artificial limbs covering the period from 300 B.C. and including the latest investigations following World War II and the Korean conflict.

The report is outstanding due to its thorough investigation of materials that have been used up to the present time and new materials the use of which is unique to the manufacture of limbs by the U.S. Navy. It contains tables of comparison of basic materials used in the manufacture of artificial limbs by the U.S. Navy. It contains tables of comparison of basic materials used in the manufacture of artificial limbs, such as willow wood, bone fiber, aluminum sheet ST, as well as the plastic material under investigation, Selectron No. 5007 in conjunction with Allymer fiberglass. This list also contains tables concerning esthetic and physiological considerations, fabrication, fitting, and cost, as well as anthropometric measurements for establishing norms used in the production of shins. Investigation and production methods are described and tables are provided detailing the laboratory tests made of prehensile strength of rayon, nylon, fiberglass and cotton stockinet. These tables contain fundamental data as to wall thickness, weight in ounces and compression due to failure, in pounds per square inch.

The methods and machinery used for the tests are described and illustrated. Compression tests used on fiber, wood, canvas-adhesive and aluminum shins are also described or documented. Accelerated testing machines were used in order to establish fatigue failure.

After the accelerating tests, a field study was conducted, using accepted testing procedures on 100 amputee subjects, to investigate the laboratory findings under normal amputee wear. This field data study contains information relating to site of amputation and the age, occupation and weight of the amputees. Tables are given of breakage, shin weight, rivet retention, cosmetic appearance, and acceptability.

The conclusion arrived at in this report is that the cost of a plastic shin for artificial legs is considerably below that of any shin manufactured in the conventional manner, the strength of plastic material is superior, cosmetic appearance is excellent, and 99 per cent of all pilot wearers have accepted the plastic shin without any reservations.

VITAMINS AND HORMONES, ADVANCES IN RESEARCH AND APPLICATIONS. Edited by *Robert S. Harris, G. F. Marrian*, and *Kenneth V. Thimann*. Vol. XII. Cloth. Price, $7.50. Pp. 305. Academic Press Inc., 125 E. 23rd St., New York 10, 1954.

This volume representing recent advances in this double field, covers not only animal and plant physiology but touches on such diverse things as medicine and animal husbandry. There are chapters on the chemistry of vitamin B-12; the intestinal synthesis of vitamins in the ruminant; hypervitaminosis A; vitamin A requirement of animals; disturbances in nutrition relating to liver disease in man; light regulation of hormone secretion; estrogenic substances in plants, and effects of estrogens on poultry.

The reviewer has not seen a volume of this series for several years. The decision to mix nutrition and endocrinology probably was

taken years ago when both subjects were much less vast than they are now. There seems otherwise no good reason to continue a series of recent advances in books like this one with this peculiar combination, this, notwithstanding the acknowledged instances in which there are interactions between vitamins and hormones. The chapter on vitamin B-12 brings out the point that there is a whole family of substances having B-12 properties. The intestinal synthesis of vitamins—apparently one of the main functions of the rumen of cattle—has its obvious counterpart in the colon of human beings. Vitamins of the B complex are needed by every living cell, plant and animal, apparently even by the bacteria whose activities synthesize them.

The chapter on hypervitaminosis A is interesting if somewhat unimportant, the toxic dose in man being so high that it is rarely encountered. The acute symptoms are abdominal distress, nausea, headache and dizziness. There may also be desquamation of large areas of skin. The chronic symptoms consist of loss of appetite, growth failure, irritability, bone lesions, itching and fissures in the corner of the mouth, coarsening as well as loss of hair. The bone lesions consist of periosteal thickening accompanied by pain in the extremities. Apparently good recovery follows removal of the excess vitamin A. The most interesting chapter in the book from the point of view of medicine is the chapter by Davidson on nutrition and liver disease in man. The old debates concerning cirrhosis (kwashiorkor) in the tropics, the role of alcohol, the nature of pigment cirrhosis and Wilson's disease are all reviewed. Final conclusions still are not available.

One of the most fascinating chapters is concerned with regulation of hormone secretion by light energy and its relation to the built-in rhythms of animal and plant life. Equally diverting is the intelligence that a good many plants contain substances closely mimicking animal estrogens at least in their effects. Thus the love-philtres of the ancients at last make some sense—at least when destined for a lady—when one reflects that considerable amounts of these substances are present in garlic, oats, beets, palm kernels, sage, subterranean clovers and tulips, with even the pussy willow containing a moderate quota.

On the practical side, the commercial importance of plants containing estrogens is emphasized by the fact that the feeding of estrogens is an accepted part of fattening of steers and other beef animals. In the poultry industry chemical caponizing and the preparation of meat birds by use of estrogens has been long established. Here, also, the two topics of vitamins and hormones really come together, for it has been found that antithyroid substances and estrogen act synergistically.

As a final reflection, human kind has come to think in a very proprietary way about things like hormones, but these other creatures are entitled to feel just as proprietary. It is all in the species if not in the point of view. Thus if you are a hen, estrogens reduce your sexual activity, but if you are a turkey, they have the opposite effect.

FRACTURES IN CHILDREN. By *Walter P. Blount*, M.D. Price, $9.50. Leatherette. Pp. 279, with illustrations. The Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, 1955.

The author has documented for the first time in a broad perspective, the treatment of fractures in children. The presentation is clear, precise and amply illustrated with excellent radiographs, diagrams and several didactic cartoons.

The separate consideration of fractures in children is ably justified in the presentation. Attention is directed to differential diagnostic problems which are not present in adults. Considerable stress is placed on epiphyseal injuries with long range results. The emphasis throughout is on conservative treatment with only rare indications for operative intervention. Long range follow-up films are repeatedly introduced to support this contention and stress the need for alignment as the chief requirement with considerably less significance attributed to opposition of fragments. Shortening is recognized as an acceptable and often necessary requirement as shown by long range follow-up films illustrating the compensatory overgrowth stimulated by the fracture. This should be reassuring to many physicians who are accustomed to treating the radiograph rather than the individual.

Immobilization is the cardinal principle which is stressed throughout. The author is vigorous in his opposition to any physical therapy procedures in the "management of uncomplicated children's fractures." This is particularly true in fractures about the elbow joint where pain should be considered the limiting factor in the activation of the joint. The physical therapist is depicted in a cartoon as a two horned Amazon vigorously stretching the elbow of a child. It should be recognized that vigorous stretching in children has been discarded by most physiatrists as unphysiological especially where the possibility of a myositis ossificans is present. Active supervised exercises with proper parental instruction can restore the last few degrees of flexion and extension the loss of which are often accepted as inevitable.

Fractures and subluxations of the spine are presented with excellent films illustrating epiphyseal growth disturbances which might be confused with fractures. The infrequency of cord complications is reiterated.

The book is highly recommended to all physicians interested in the care of children.

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*Read: Archives of Physical Medicine & Rehabilitation May, 1955, pages 282-287

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8:30 A.M. Registration

9:00 A.M. HISTORICAL NOTES ON ELECTROMYOGRAPHY. Y. T. Oester and John Fudema,* Chicago.

ELECTROMYOGRAPHY AS AN AID IN THE DIAGNOSIS, PROGNOSIS, AND TREATMENT OF SPINAL ROOT LESIONS. James Golseth, Pasadena, California.

DIFFICULTIES IN ELECTROMYOGRAPHY. Joseph N. Schaeffer, Peoria, Illinois.

ELECTROMYOGRAPHY IN MUSCULAR DYSTROPHY. Max Karl Newman, Detroit.

ELECTROMYOGRAM IN MUSCULAR ATROPHY. A. A. Marinacci, Los Angeles.

ELECTROMYOGRAPHIC STUDIES OF AMYOTROPHIC LATERAL SCLEROSIS ON THE ISLAND OF GUAM. E. Lambert, Rochester, Minnesota.

ELECTROMYOGRAPHIC ACTIVITY OF THE MUSCLES OF THE FOOT. Fred Sheffield,* A. Mastellone, and J. Gersten, Denver.

EXPERIMENTAL IMMOBILIZATION AND ELECTROMYOGRAPHIC FINDINGS. John Fudema,* J. A. Fizzell,* and E. M. Nelson,* Chicago.

12:00 P.M. Noon LUNCHEON

—GUEST SPEAKER—

1:30 P.M. THE PROCESS OF EXCITATION AND THE ACTION POTENTIAL OF STRIATED MUSCLES IN MAN. Paul Hoefer,* New York.

STUDIES ON THE ORIGIN OF THE POSITIVE WAVE. E. Lambert, Rochester, Minnesota.

ELECTROMYOGRAPHY IN PERNICIOUS ANEMIA. John Boczkiewicz,* A. A. Rodriquez, and Y. T. Oester, Chicago.

ELECTRODIAGNOSIS IN PERIPHERAL NERVE PRESSURE PARALYSIS. Joseph Moldaver, New York.

ELECTROMYOGRAPHY IN AFFECTIONS OF THE FACIAL NERVE. A. A. Rodriquez, and Y. T. Oester, Chicago.

THE USE OF THE ELECTROMYOGRAPH IN A CASE OF GLYCOGEN STORAGE DISEASE. Francis J. Bonner and William Schmidt, Philadelphia.

ELECTROMYOGRAM AND TEMPORAL MANDIBULAR FUNCTION. Joseph R. Jarabak,* Y. T. Oester, and A. A. Rodriquez, Chicago.

4:30 P.M. BUSINESS MEETING.

6:00 P.M. SOCIAL HOUR — DINNER

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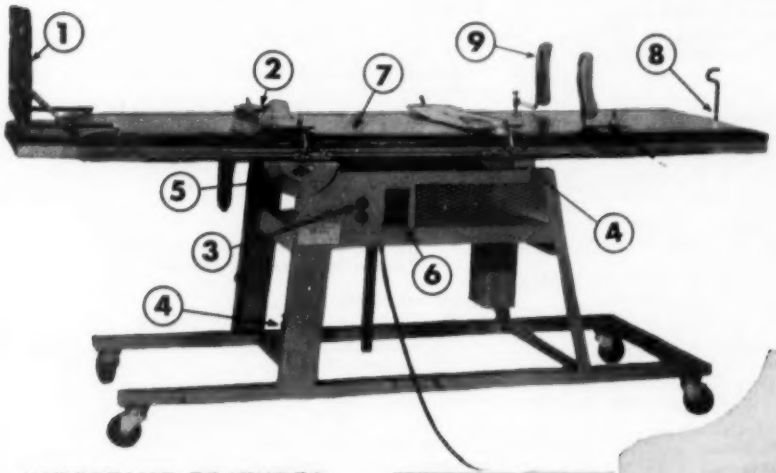

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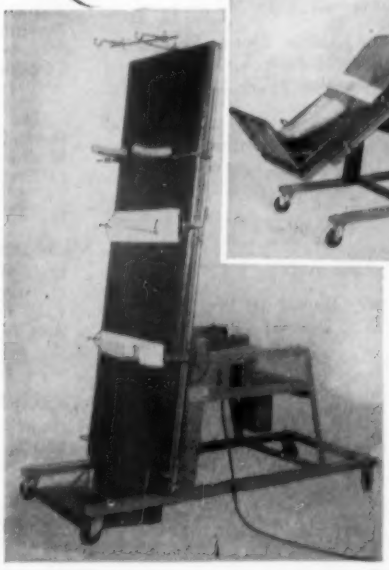

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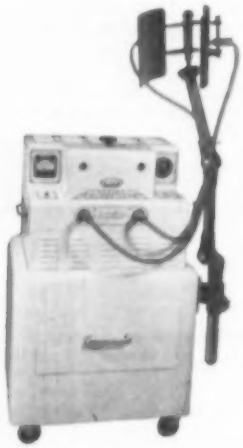

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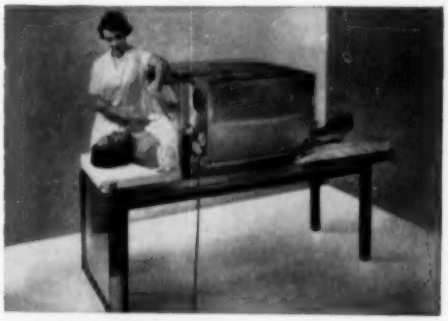

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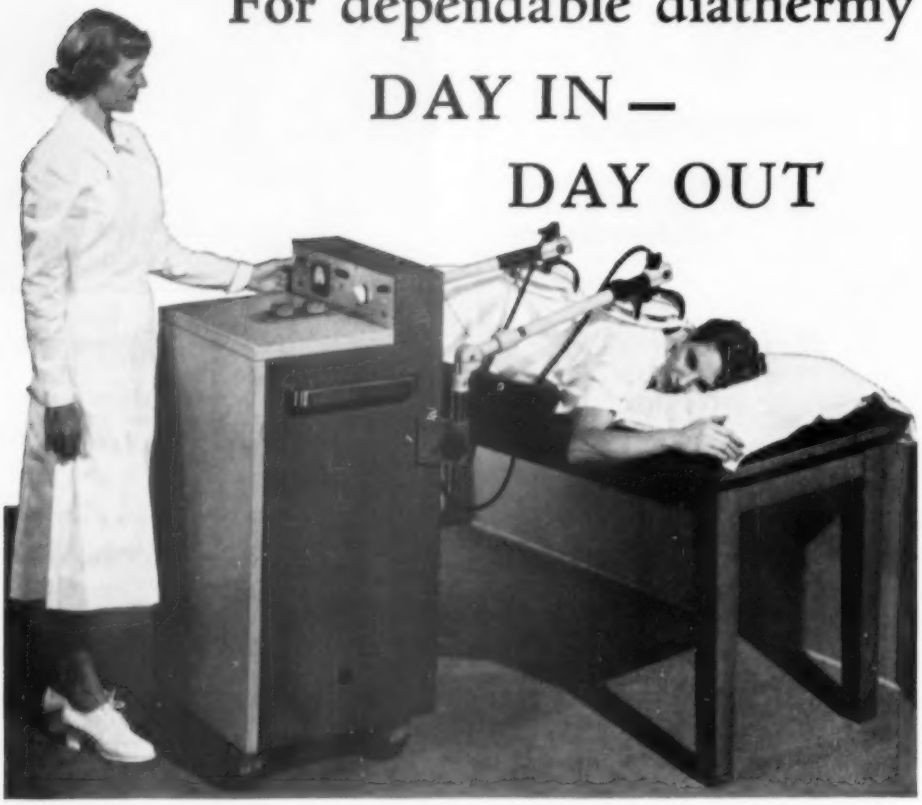

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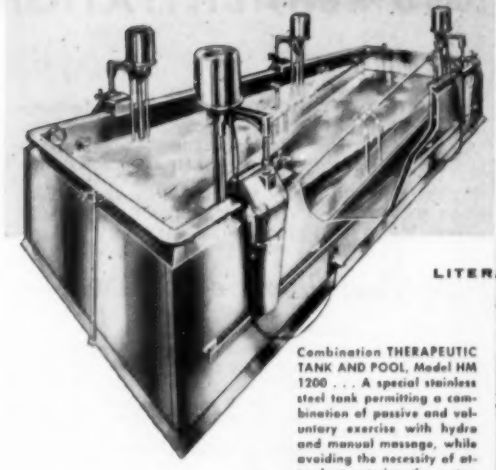

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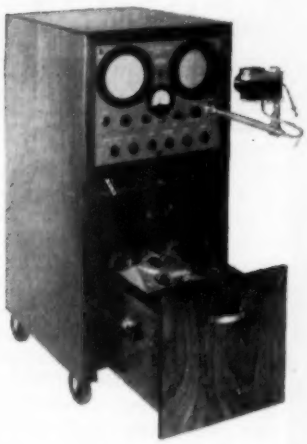

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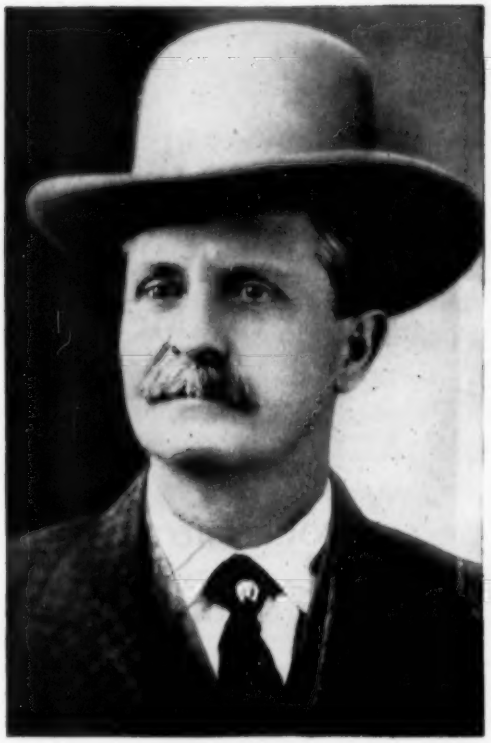

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PERIPHERAL VASCULAR AND PERIPHERAL NERVE DISEASE

Monday, August 29

9:00 - 9:50 A.M. PATHOLOGY OF PERIPHERAL BLOOD VESSELS. **A. James French, M.D.,** Ann Arbor, Mich.

10:00 - 10:50 A.M. TREATMENT OF PERIPHERAL VASCULAR DISEASE. **Karl Harpuder, M.D.,** Bronx, N.Y.

11:00 - 11:50 A.M. NEUROANATOMY OF THE EXTREMITIES. **George C. Rinker, M.D.,** Ann Arbor, Mich.

2:00 - 2:50 P.M. VALUE AND LIMITATIONS OF ELECTRICAL STIMULATION IN PERIPHERAL NERVE LESIONS. **Jerome Gersten, M.D.,** Denver.

3:00 - 3:50 P.M. MUSCLE ACTION POTENTIALS: THEIR CAUSE AND MEASUREMENT. **Edward H. Lambert, M.D.,** Rochester, Minn.

4:00 - 4:50 P.M. ELECTRODIAGNOSTIC METHODS IN PERIPHERAL NERVE LESIONS. **H. D. Bouman, M.D.,** Madison, Wis.

Tuesday, August 30

8:00 - 8:50 A.M. PHYSICS AND PHYSIOLOGICAL EFFECTS OF ULTRASOUND WITH EMPHASIS ON ITS EFFECT ON PERIPHERAL MUSCLES AND NERVES. **Justus F. Lehmann, M.D.,** Columbus, Ohio.

9:00 - 9:50 A.M. NERVE REPAIR AFTER INJURY. **E. S. Gurdjian, M.D.,** Detroit.

PSYCHIATRIC AND VOCATIONAL TOPICS OF REHABILITATION

Monday, August 29

9:00 - 9:50 A.M. PERSONALITY STRUCTURE AND ITS EFFECT ON REACTION TO CRIPPLING ILLNESS. **John C. Nemiah, M.D.,** Boston.

10:00 - 10:50 A.M. HELPFUL AND HARMFUL ATTITUDES OF THERAPISTS AND PHYSICIANS TOWARD PATIENTS **Jack Meislin, M.D.,** Montrose, N.Y.

11:00 - 11:50 A.M. PSYCHIATRIC ASPECTS OF CHRONIC BRAIN DISORDERS AND THEIR IMPORTANCE IN PHYSICAL MEDICINE AND REHABILITATION. **M. M. Frohlich, M.D.,** Ann Arbor, Mich.

2:00 - 2:50 P.M. PSYCHOTHERAPEUTIC EFFECTS OF EXERCISE AND WORK THERAPY. **Ivan C. Berlien, M.D.,** Detroit.

3:00 - 3:50 P.M. VOCATIONAL APTITUDE TESTING. **Kenneth W. Hamilton, Ph.D.,** Columbus, Ohio.

4:00 - 4:50 P.M. PRINCIPLES OF VOCATIONAL TRAINING FOR THE HANDICAPPED. **Kenneth W. Hamilton, Ph.D.,** Columbus, Ohio.

Tuesday, August 30

8:00 - 8:50 A.M. THE SHELTERED WORKSHOP AS A STAGE IN REHABILITATION. **Emil Trapani,** New York City.

9:00 - 9:50 A.M. INDUSTRIAL PLACEMENT OF THE PHYSICALLY HANDICAPPED. **E. A. Irvin, M.D.,** Dearborn, Mich.

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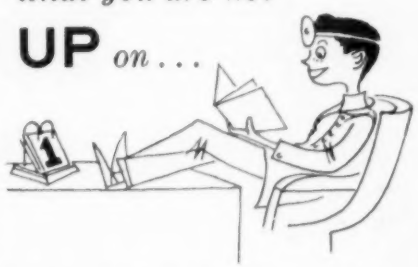

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